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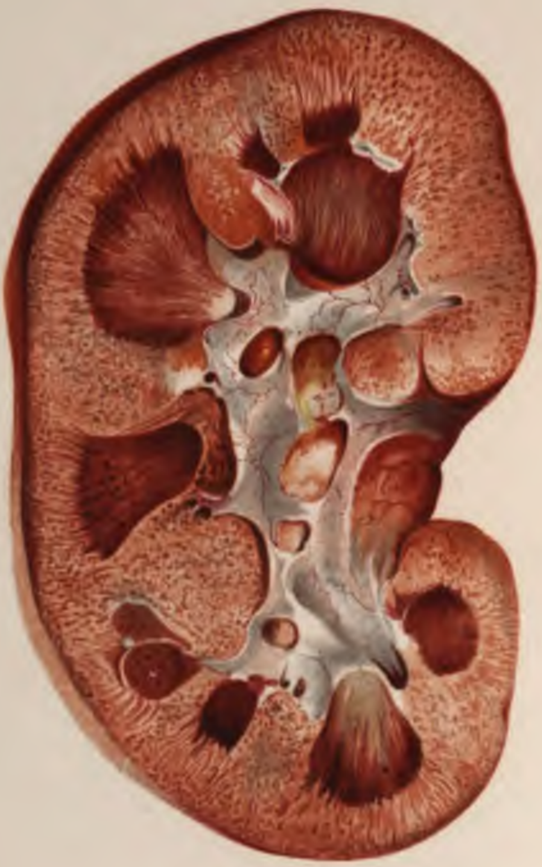

SCARLATINAL NEPHRITIS (*From case of* [illegible] [illegible])

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ON THE

PATHOLOGY AND TREATMENT

OF

ALBUMINURIA.

BY

WILLIAM H. DICKINSON, M.D. CANTAB.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS; ASSISTANT PHYSICIAN
TO ST. GEORGE'S HOSPITAL AND TO THE HOSPITAL FOR
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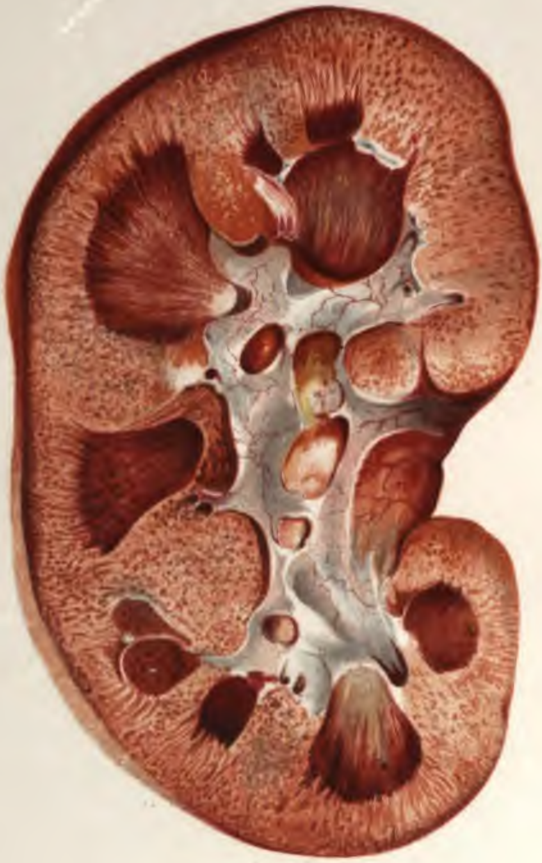

SCARLATINAL NEPHRITIS. (*From case of Wallace.* [illegible])

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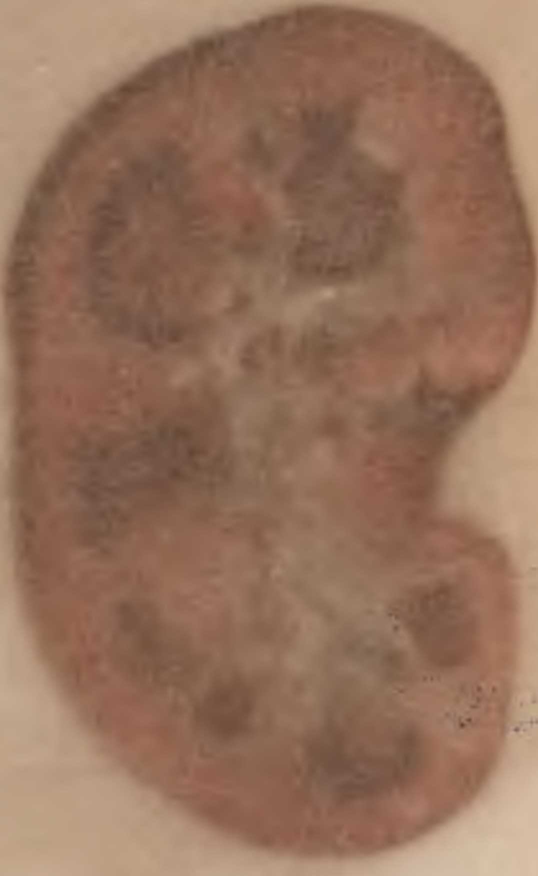

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TO

WILLIAM DICKINSON, ESQ.

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NEW PARK, BROCKENHURST,

These Pages are Inscribed

BY

HIS SON

THE AUTHOR.

PREFACE.

THE RAPID SUCCESSION of works upon diseases of the Kidneys has apparently been due to the unexampled progress which, of late years, has been made in renal pathology; and it is the hope of the author that it may be said of this volume, as of its predecessors, that it is the offspring of advancing knowledge.

The great field of research which, until the time of Bright, was veiled in primeval obscurity, has since been cultivated with an assiduity which has more than made up for centuries of neglect.

Bostock, Owen Rees, and Christison, supplied much that we know regarding the chemistry of the diseases which Bright had discovered, and Wilks as a pathologist established broad classifications which will probably never be entirely superseded.

The original treatise of Dr. George Johnson on this subject showed the importance of the microscope, both in its relation to morbid anatomy and as a means of diagnosis; and while adding to our knowledge of disease directed the researches of succeeding enquirers.

But it would be impossible even to name the writers who, in England, on the Continent, and in America, have helped to advance this branch of medicine.

The great work of Rayer has a permanent place in medical literature. Prout, Bence Jones, and more recently Dr. G. Harley, have advanced urinary pathology in its chemical relations. Dr. Goodfellow, in the form of lectures, published a valuable and suggestive treatise, and Dr. Basham is the author of a work which has become well known, and has been commended as eminently practical. The important papers of Dr. Grainger Stewart contributed to elucidate the disorder to which Virchow had applied the term 'Amyloid;' and Dr. Roberts in his recent work upon Renal Diseases has furnished an admirable compendium of our present state of knowledge.

While profiting by the labours of others it has been the aim of the author to record facts rather than to collect opinions, to appeal to observation rather than to authority, and of all books to consult chiefly the book of nature. In giving the results of clinical observations the naked distinctness of numerical statement has been often preferred to the more attractive vagueness of general description.

Some of the views which are advanced by the author, particularly as to the intertubular origin of Granular Degeneration, and as to the nature of the change to which the term 'amyloid' has hitherto been applied, have been already made public through the medium of the Medico-Chirurgical Society, but he still feels that in other parts of his subject he is treading on new and dangerous ground, and particularly appeals to the forbearance of his readers in the chapter which bears upon the effects of climate. Even had he the capacity to deal with so large a subject as the relationship of atmospheric influences to disease, he could not do so with accuracy or completeness until meteorological stations are more widely scattered, renal disease is more generally understood, and systems of registration are more widely adopted.

At present have been considered only those renal changes which are declared by albuminous urine; it is the purpose of the writer at some future time to treat of the remaining disorders to which the kidney is liable.

As to the pictorial part of the work, it may be hoped that it will help to make up for the shortcomings and deficiencies of the text. No pains have been spared either by Messrs. Hanhart, Dr. Westmacott, or Mr. Tuson, to secure truth in the coloured illustrations. As to the representations of microscopic sections, it may be said that their accuracy is sufficiently attested by the fact that they were all drawn with the camera lucida, and by Mr. Tuffen West.

In conclusion, the author has to acknowledge his obligation to Dr. Sturges for revising the work in its passage through the press; he has to thank Dr. West and Dr. Hillier, his colleagues at the Children's Hospital, for allowing him to refer to their note-books of hospital practice; and he is indebted to his predecessors and colleagues at St. George's, whose liberality has enabled him to use without restriction all the resources of the hospital, and to bring forward numerous and various cases which may have value as faithful records of disease, whatever may be the worth of the inductive portion of the work which now asks for indulgent consideration.

CHESTERFIELD STREET, MAYFAIR:
December 1867.

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SECTION of a Kidney in a state of acute Tubal Nephritis, the result of Scarlatina. The case is given at length (Vallance, page 69). The kidney is much congested, though that condition is partly hidden by the opaque white matter which occupies the tubes, and causes the increase of size in the cortex. Owing to this congestion, the organ is not so white as it is apt to become later in the disease. The surface of the organ is not shown. It was perfectly smooth.

PLATE II., *to face page* 26.

A Section cut from a Kidney affected by Tubal Nephritis, in which Fatty Degeneration of the Epithelium has taken place to a considerable extent. The tubes are not evenly obstructed, but patches of tubes are distended to opacity, while others are clear and translucent. The tubes are all in contact with each other, showing the absence of any intertubular growth.

The section was made from a portion of kidney which had been boiled.

The organ from which the section was obtained was a beautiful specimen of the speckled kidney described in page 26. The surface was smooth to the touch. The tubes were loaded with fatty epithelium.

The subject of the disease was a boy, who died during an attack of convulsions, having had albuminuria and general dropsy for ten weeks. The cause of the attack was uncertain.

PLATE III., *to face page* 42.

Fig. 1.

State of the Tubes in Nephritis. The epithelial lining has generally been removed, while the tubes are occupied by epithelial cells and fibrinous matter. Both the epithelium and the fibrinous matter are in some cases dotted with oil globules. Both convoluted and straight tubes are seen, the former being the more distended. (See p. 23.)

Fig. 2.

Casts of Tubal Nephritis. All the casts represented were obtained from patients in whom the nature of the disease was placed beyond doubt, either by post-mortem examination or by the fact of recovery having taken place. Most contain epithelial cells; some, granular matter. Some are simple cylinders of fibrine. One bears evidence of having had a double origin, as explained in page 17, a large cast including others in its interior. (See p. 42.)

PLATE IV., *to face page* 96.

A pair of Kidneys affected by Granular Degeneration. They are of unequal size. The larger has had the capsule removed, so as to display the regular arrangement of granulations beneath. The smaller, which has the capsule partly removed, shows a number of cysts projecting from the surface. As not unfrequently happens, the contracting process has gone on unequally in the two kidneys, giving rise to the greater number of cysts where the shrinking has been the most. The outsides only have been shown, since it is by the state of the surface that granular degeneration is chiefly characterised. Had the organs been shown in section, the most noticeable fact would have been diminution of the cortical substance.

The kidneys represented were taken from the body of a well-known jockey, who died at the age of forty-eight, having had albuminuria, dropsy, and obstinate vomiting, followed by coma. He had had gout. At the post-mortem examination the kidneys were in the condition depicted, with extreme shrinking of the cortices, evident on section. The left ventricle of the heart was hypertrophied. The brain was anæmic and wet, and there was an incrustation of urate of soda upon the cartilages of the great toes. With these exceptions all the organs were natural.

PLATE V., *to face page* 100.

Fig. 1.

Section of an advanced Granular Kidney, made by Mr. Lockhart Clarke's process (chromic acid, &c.). It shows an extensive intertubular growth of fibro-nucleated tissue, which is most abundant in the neighbourhood of the capsule, a portion of which is seen along the upper edge. The surface is depressed opposite to the new formation. Within the larger mass of new tissue two blood vessels are seen. The malpighian bodies are enlarged. The tubes are generally empty.

The kidney from which the section was cut was obtained from the body of a man fifty years of age, who had long been subject to gout. Latterly he had had dropsy, the urine being scanty, albuminous, and containing dark granular casts. He died suddenly, having had vomiting, rigors, and faintness. The lungs were found to be highly congested, and there was an extensive coagulum in the pulmonary artery, which apparently had been the immediate cause of death. There was valvular disease of the heart, the mitral valve being dotted with urate of soda. The kidneys were greatly contracted, the pair weighing only 5½ oz. The surfaces were highly granular, and showed numerous cysts. Urate of soda was seen in the renal tissue.

Fig. 2.

A Section from a Healthy Kidney, made in the same way as that represented above, and magnified to the same extent, given as a standard of comparison. The tubes are in apparent contact with each other, and with the capsule; there are no spaces between, and no accumulations of fibroid material. The epithelium is seen in regular arrangement along the sides of the tubes.

PLATE VI., *to face page* 117.

Section of the Kidney of a woman who died of Puerperal Convulsions, having had Albuminuria and Œdema during her pregnancy. The case is given at length, page 116. (S. Van. G.)

The section shows a state of extreme congestion without any of that white opacity which is evidence of a deposit in the tubes. The cones are of a deep purple colour, the cortex rather more florid. The gland is considerably increased in bulk, chiefly in consequence of the injection of the vessels. The surface is not shown, but was perfectly smooth and of a similar colour to the section.

PLATE VII., *to face page* 140.

Fig. 1.

Represents all the varieties of Casts which were discovered in the cases of Granular Degeneration upon which the account of the disease is based, making use only of the cases attested by post-mortem examination.

The greater number of casts contain coarse dark granular matter; some are of finer texture; a few contain blood globules or epithelial cells. (See page 140.)

Fig. 2.

Casts from the Depurative or Waxy Kidney. Cases all attested by post-mortem examination. The casts are of two varieties, simple cylinders of fibrine, and casts such as occur with nephritis imbedding epithelial cells. Judging by the casts alone it might be difficult to discriminate between nephritis and the depurative disease. (Compare with Plate III.) See page 195.

PLATE VIII., *to face page* 178.

Section of a Kidney affected by the Depurative or 'Amyloid' change. The organ is much increased in size, the increase affecting chiefly the cortical portion. This has a pale buff colour, slightly variegated with spots of vascularity. The waxy change in this case, as often happens, was associated with the accumulation of fatty epithelium in the tubes, hence the great increase of size. A part of the section has been treated with iodine, and shows the effect of that reagent upon the malpighian bodies and the straight vessels of the cones. The former come out as black dots, the latter as dark lines, while the intervening structure is comparatively pale.

The outside of the organ was smooth and buff-coloured; it has not been represented.

The kidney was obtained from the body of a soldier who had served in India, and had dysentery and abscess of the liver. He had albuminous urine with dropsy and vomiting, and eventually died in a state of semi-coma. There was extensive hepatization of the lungs.

PLATE IX., *to face page* 181.

Fig. 1.

Section made by Mr. Lockhart Clarke's process, from a large waxy kidney of which the surface was covered with large curved depressions.

The part represented was opposite to a depression. A large expanse of finely nucleated tissue is seen passing inwards from the capsule, separating the tubes and surrounding the malpighian bodies. The tubes in the neighbourhood contain detached epithelial cells.

At the right-hand side is a part of the new growth, highly magnified, so as to show its fibro-nucleated structure.

Part of a malpighian body appears at one corner; at the other, convoluted tubes. (For comparison, see healthy kidney, Plate V.)

The kidney from which the section was cut was affected in a very characteristic manner. It was obtained from the body of a man who had had an arm amputated for disease of the elbow five years before his death. The immediate cause of death was peritonitis, associated with infiltration of the coats of the duodenum with pus. The liver, like the kidneys, was waxy. No renal symptoms were recognised.

Fig. 2.

A Section of a characteristic Waxy Kidney, made after Mr. Lockhart Clarke's plan.

There is a general increase in the intertubular fibrous tissues. The tubes have lost their epithelial lining, and many contain fibrinous plugs, or casts, in their interior. These casts gave the iodine reaction in a most marked manner, taking exactly the same tint as the malpighian bodies. Another section from the same kidney, which displays the effect described, is represented in the 'Medico-Chirurgical Transactions,' vol. l. (For comparison, see section of healthy kidney, Plate V.)

The section was cut from the kidney of a man who died of ulceration of the colon.* Latterly he had had some œdema, the urine at the same time becoming unnaturally copious. Owing to the disturbed state of the bowels none could be obtained for examination. At the post-mortem the kidneys were greatly enlarged, anæmic, and of a yellowish white colour, much like that represented in Plate VIII. They gave the iodine reaction, as did the lining of the small bowel. There was a large suppurating cavity occupying the left side of the belly, and connected with the intestinal ulcers.

---

* The case is published, as an example of ulceration of the colon, in the Pathological Transactions for 1867, p. 102, case of C. Roberts.

PLATE X., *to face page* 182.

Section of a Depurative or 'Amyloid' Kidney, showing the action of iodine upon the malpighian bodies and small arteries. These are of bright reddish brown, as seen with transmitted light, while the rest of the section has acquired merely a faint yellow colour.

The darker marks upon the section are obstructed tubes. The section was made after freezing with ice and salt.

It was cut from a kidney in a very advanced state of disease, and much contracted, which was obtained from the body of a woman in whom the disease had followed upon severe syphilitic ulceration of the palate, &c.

She had œdema and ascites, the urine being copious and highly albuminous. There was much diarrhœa and vomiting. Latterly pneumonia occurred.

ALBUMINURIA.

CHAPTER I.

INTRODUCTION.

THE OBJECT of this treatise is to describe those diseases which are made known during life by the presence of Albumen in the urine. These have been classed together under the general term 'Bright's Disease,' or more recently as Albuminuria. Since the publication of 'The Medical Reports'—the work in which Dr. Bright first described the conditions of kidney associated with his name—pathologists have been busy in building upon the foundation he laid.

With the improved means of research which the microscope has given us, and with a rapidly advancing knowledge of animal chemistry, many refinements have been added to the great discovery of Bright.

Classification.

Many and various subdivisions have been made of the conditions which give rise to dropsy and albuminuria. It would be a weary and unprofitable task to follow pathologists into details of classification, frequently of a highly imaginative character, with which this part of medical literature is burdened. But, while avoiding fanciful distinctions, it will be seen that there are several disorders, different from each other in their cause, their symptoms, and their morbid anatomy, which Dr. Bright associated with albuminous urine.

It is the object of the present volume to remove some of the obscurity and confusion in which the subject has been involved, by establishing such demarcations as are suggested by morbid anatomy, and warranted by clinical observation.

Structure of kidney. Tubes.

For the purposes of the physician the kidney may be divided into three parts. It consists, first, of a complication of tubes, which, with the malpighian bodies in connection with them, are the sources of its secretion, and are the essential elements of the gland. Secondly, these structures are bound together by a delicate web of fibrous tissue, which, in a section prepared so as to show it, has the appearance of a fine uniform network. This pervades the entire bulk of the organ surrounding and supporting every tube and each malpighian body. Thirdly, the gland is abundantly supplied with blood vessels, which lie with the fibrous tissue between the tubes. Some blood vessels, indeed, of the smallest size, enter into the construction of the malpighian bodies; but with this exception the blood vessels, like the fibrous tissue, are intertubular structures. It is unnecessary to describe with minuteness a structure which will be familiar to every person who is acquainted with the rudiments of physiological anatomy. It is only needful to insist upon the triple constitution of the organ by means of tubes, fibrous tissue, and blood vessels.

Fibrous tissue, and blood vessels.

POST-MORTEM STATE OF THE HEALTHY KIDNEY.

Since much of what is advanced in the ensuing pages is based upon alterations found after death in one or other of these components of the organ, it is necessary to ascertain first of all what is its normal condition. It is necessary to know what appearances are presented by the tubes, the intertubular fibrous tissue, and the blood vessels, in persons who have died of disorders other than renal. It will be necessary to remove from consideration such changes in the kidney as are of post-mortem origin; and also those variations which depend upon conditions which are common to the whole body, and do not imply any deficiency or peculiarity in the kidneys themselves. The neglect of such precautions has been a fertile source of pathological mistakes.

No detailed description will be needed of an organ so often examined and so well known. The capsule of the kidney is thin and translucent, and holds very loosely to the smooth surface beneath. Upon this surface are no vessels large enough to be singly visible; but it is uniformly covered with a fine network, the meshes of which are just evident without a glass, and of which each thread consists, not of a single vessel as might be supposed, but of a multitude of capillaries. On section the well-known brown substance of the cortex separates the cones, and forms a barrier ordinarily about a quarter of an inch in width, between their bases and the capsule. The appearance is liable to much variation within the limits of health, consequent upon the differences in the amount of blood contained; and a delusive appearance of congestion often arises from staining of the tissues by blood which has become unnaturally fluid, as the consequence of febrile disease, or sudden death.

Naked eye appearances.

The ordinary appearances of the several renal structures, as seen with the microscope, must be taken into consideration. With regard to the tubes and epithelium in particular it will be needful to be explicit, in consequence of the undue prominence which changes in the epithelial cells have obtained. These cells are sometimes charged with oil globules — a change at one time looked upon as the root of all evil. They have been variously described as 'granular,' 'opaque,' 'crumbling,' 'disintegrated,' 'nebular,' 'degenerate,' &c. It will be shown that each of these conditions may be present independently of renal disease.

Under the microscope.

With a view of ascertaining what variations of the renal tubes and their contents may be consistent with health, and what must be held to indicate a diseased action, I examined with the microscope the cortex of the kidney in 100 consecutive subjects, in the post-mortem room at St. George's Hospital. The kidneys in 68 cases had the appearance of health, and had belonged to persons in whom there had been no symptom of renal disease. In 32, either in the appearance of the organ or the history of the case there was some evidence or likelihood of renal change. It must be stated

Examination of 68 healthy kidneys.

that the microscopic examination in all these cases was made as soon after death as the laws of the hospital permitted.

In the 68 healthy kidneys there were 3 in which the tubes were not made out. The following table shows their condition in the remaining 65. Many kidneys afforded tubes in several different states.

Table showing the State of the Convoluted Tubes in 65 Healthy Kidneys.

Condition of Tubes.	No. of cases in which present.	No. of cases in which oil globules were found.
Cavity distinct, epithelium in place	9	1
Uniformly filled with epithelium, cells distinguished either by nucleus or outline	44	3
Uniformly filled with amorphous granular matter	13	1
Empty, or containing only a few scattered cells	10	1
Containing fibrinous matter	3	1
Filled with oil globules	3	3
Containing oil globules mixed with other contents	7	7
Tubes distended	6	
Excess of fibrous tissue in cortex	3	
Partial colour from solution of iodine	0	

In the 68 cases the state of the cortical epithelium was the following:—

State of Epithelium in 68 Healthy Kidneys.

Typical cells found in	29
Granular contents, but nucleus visible	31
Granular contents, nucleus hidden	14
Opaque, so as to hide nucleus, but not granular	1
Oil globules in cells	25
Coloured with bile	1
Yellow or brown colour (blood-stained)	12
Small and irregular in shape	1

When epithelial cells are described as 'typical,' it is meant that the cell is natural in size and shape, the outline and the nucleus well defined, and the contents uniform, transparent, and colourless.

Variations independent of

From these details it would seem to be rare to find either tubes or epithelium, in the state which is generally looked renal disease.

upon as normal. The convoluted tube in its ideal perfection displays a regular arrangement of epithelial cells around a central cavity. The cells themselves are smooth and translucent, with a nucleus clearly visible through a transparent envelope. Such tubes and cells are but seldom exposed to view in the human subject. The disguising power of death is quickly shown upon their delicate structure.

Cells, granular or disintegrated.

The cells rapidly become granular. They crumble and disintegrate, the outer portion breaking away from the nucleus. They separate from the basement membrane of the tube, and fill the cavity with uniform packing, in which the outlines of cells and nuclei may be recognisable, or may have altogether disappeared in a granular débris.

Tubes obstructed.

Cells tinted with blood,

Besides such alterations in texture, the cells often derive a yellowish-brown tint from an unnaturally fluid state of blood. In the twelve cases in which this discolouration of the epithelium was found the blood was thus altered in nine. Blood in this state stains not only the surfaces in contact with it, but the epithelial cells all over the body. It is difficult to say whether the action takes place after death or before.

Or bile.

The renal epithelium sometimes receives a bright yellow colour from bile; this may occur whenever from any cause jaundice is present. Some cells are usually intensely affected, while others completely escape. This change, of course, takes place during life, and is the result of a vicarious secretion on the part of the kidney.

Fatty change in cells no proof of renal disease,

Next to a loss of smoothness and transparency, a deposit of oil between the cell wall and the nucleus is the most frequent change to which the renal epithelium is liable. It is in all cases the result of vital change, not the effect of decomposition after death. After the fatal termination of chronic disease oil is very often present in the renal epithelium, particularly when the disorder has been tuberculous. After acute disease the rule is to find the cells free from oil. In thirty-eight cases in which death had been caused by acute disease or accident, the renal epithelium was found to be fatty in nine. In thirty cases of chronic disease the same change was present in sixteen. Among the cases of chronic disease there were fifteen in which the affection was tubercular; of these the epithelium was fatty in ten.

The renal epithelium, like the epithelium of other organs, appropriates or parts with oil in obedience to influences which act upon the general structure of the body. The amount of oil contained in the cells of the liver varies with digestion, as well as with the changing phases of disease. After long illness, the epithelial cells all over the body are sometimes found to contain visible oil globules. If the disorder had been such as to allow of recovery, there can be little doubt that the cells would have reverted to their former state. Within certain limits, oil globules appear to be very transitory tenants of the epithelial cells, depending for their deposit or removal upon the changing composition of the blood. The presence of oil in the renal cells, even to a large amount, does not necessarily interfere with the action of the gland.

though often associated with it.

But the change may arise under other circumstances. There may be an especial and local cause to determine the deposit of oil in any particular tissue. The lung, the brain, the kidney, or a portion of muscular fibre, may become charged with oil globules, in consequence of a morbid action limited to the part itself. Extreme fatty change is often found in the superficial fibres of the heart, under the influence of pericarditis, while the deeper fibres escape.

When renal dropsy is brought on by cold, that is when a state of tubal inflammation has been set up in the organ by that cause, it is usual to find the epithelium loaded with oil. The fatty change is the result of the local disturbance. Thus it appears that a deposition of oil in the renal epithelium may coexist with renal disease, as well as with an efficient state of kidney. The alteration may be produced by an inflammatory action in the gland itself, and will then occur in conjunction with other structural changes, and with impaired function. It may also take place in the kidney in common with other organs, in conformity with a general state of system, unaccompanied by any other alteration of structure, or by any sign of renal disease.

Epithelium and tubes.

So far, then, it has been shown that without any disturbance in the function of the kidney, there is a great variety in the appearance of the tubes after death, and in the state of the epithelium. The cells may be opaque, cloudy, granular, fatty, variously coloured, 'crumbling' or broken up until nothing can be recognised but their nuclei. There is almost as great a variety in the appearances which the tubes may present, though there have been no renal disorder. If, however, the tubes are obviously increased in width, if they contain fibrinous matter, or if they have lost their epithelial lining, the presence of kidney disease must be inferred.

Fibrous tissue.

Beside the tubes and the epithelium which they contain there is an uniform fibrous structure, which passes everywhere throughout the gland, separating and holding in position the tubes, blood vessels, and malpighian bodies. In a section made from a healthy kidney, this fibrous tissue is so uniformly spread that it is scarcely visible except around the larger vessels. The envelope which it supplies to the malpighian bodies is barely evident, from its tenuity. The fibrous *matrix*, as it is called, is so slender and so evenly dispersed, that its existence has been called in question. In a section made from a healthy kidney, the tubes and malpighian bodies lie in apparent contact with each other, and the former structures are in seeming contact with the capsule which covers the outside. The capsular edge of the section presents an unbroken arrangement of tubes, all of about the same width, and without any spaces between them. These appearances are shown in plate (5).

In certain forms of disease, however, obvious changes take place in these respects. The tubes become separated from each other, especially near the surface; the fibrous tissue around the vessels and malpighian bodies becomes conspicuous from its extent, and in advanced stages of disease, even, large portions of the organ are occupied by fibrous tissue, to the exclusion of all other structures.

This preliminary sketch would not be complete without

Blood vessels.

mention of the blood vessels. Under ordinary circumstances these portions of the gland are not easy to see; it requires that they should be injected to make them distinct. The malpighian bodies indeed are conspicuous under the microscope, and if the section happen to include an arterial or venous trunk of considerable size it cannot escape observation; but the vessels of the sizes between the malpighian capillaries and the larger divisions are obscured by the urinary tubes between which they lie. The vessels, undistinguishable in themselves, are not made more evident by the action of any colouring matter, unless it be used as an injection. If the section of a healthy kidney be soaked in a solution of iodine or indigo, the colour will be diffused evenly over the whole. Neither of these substances will affect the blood vessels more than the tubes or fibrous tissue.

It will be seen hereafter that in a certain state of disease the blood vessels, and other parts of the organ to a less degree, are affected by the reagents which have been mentioned, in a manner which distinguishes them from the structures among which they are placed. The difference depends upon the presence of a material foreign to the normal constitution of the organ, which can be recognised by its peculiar reaction with iodine or indigo.

To sum up the changes which may be relied upon as evidence of disease, they are as follows:

Morbid appearances in the tubes,

First.—The tubes may be variously altered by the accumulation of their contents. They may be widened, perhaps irregularly; they may contain a great excess of epithelial growth; they may lose their epithelial lining and become bare; they may become filled with fibrinous matter.

in the fibrous tissue,

Secondly.—The intertubular fibrous tissue may be increased, particularly near the surface of the organ. This change may be detected in a microscopic section, and with equal certainty by the naked eye by simply observing whether or not the surface of the organ is granular. Granulations never occur without a morbid increase in the intertubular tissues of the gland, a change fertile in evil results.

Thirdly.—There is a peculiar material, which is recognised by the 'amyloid' reaction with iodine, which starts from the blood vessels and infiltrates the whole organ, giving it the appearance described as waxy. This is never found except as the result of a peculiar disease.

and in the blood vessels.

CLASSIFICATION OF RENAL DISEASE.

Thus it appears, that if we take a rough division of the gland, into the three structures which enter into its formation—the secreting tubes with their epithelial lining, the fibrous tissue between them, and the blood vessels, we have three loci of disease. Either of these structures may be primarily the seat of morbid change; and the alteration may remain for a long time, or even to the end, confined to the portion of the organ in which it has begun.

Anatomical division.

Hence we have disease of the tubes, disease of the fibrous tissue between them, and disease of the blood vessels.

This is not a mere scholastic classification. Kidneys affected in one structure are different from those affected in another, in the appearances they present after death, as well as in the symptoms to which they give rise.

Tubal disease, or Nephritis.

The broad distinctions which separate organs affected in each of these three ways may serve as an introduction to a detailed account of each.

First,* we have disease of the secreting channels. Like the bronchial tubes and all secreting surfaces, they are liable, under morbid stimuli, to an extravagance of cell growth, which is ordinarily described as inflammation. The disease is an inflammation—if morbidly increased cell growth be inflammation—limited, as in bronchitis, to the secreting surface. The tubes, particularly those in the cortex, become loaded with epithelium, which has grown from their walls in extravagant exuberance, or with fibrinous matter, which has exuded from the congested vessels. The tubes are distended, and hence the gland is increased in size, particularly in the cortical part. The large smooth kidney of Bright results. This is pale or congested, as the case may-be; at first charged with blood, latterly of a whitish colour. The capsule remains thin and loose. The surface retains to the last its gloss and smoothness. Iodine gives a pale and perfectly uniform colour to the section. In such kidneys the fibrous material is not more abundant than in health, and has undergone no change of any kind. Neither have the blood vessels changed in structure, though they may be loaded with blood. The disorder may be termed Nephritis, looking at its nature, tubal as regards its seat.

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* See a most important paper by Mr. Simon on Subacute Inflammation of the Kidney. Med. Chir. Trans., 1847.

Disease of fibrous tissue, or granular degeneration

The second form of disease is the contracted granular kidney of Bright—*granular degeneration*. Kidneys so affected are usually smaller than natural, sometimes not half their natural size, the shrinking being chiefly of the cortical part. In the earliest stages of the disorder they may be rather increased in size, but the longer the disease lasts the smaller they become. The great characteristic is a peculiar alteration of surface, which, instead of being smooth, becomes studded with little pale hemispherical granulations. The capsule is thickened, and is more firmly attached than in health. The whole organ is firm and of a fibrous texture.

These alterations are produced by a slow increase, followed by a slow contraction of the fibrous tissue which lies between the tubes. The change commences at regular intervals upon the surface of the gland, producing a depression at each starting-point. The regular arrangement of the depressions produces the superficial granulation which is the great characteristic of the disease. No amount of mere distention of the tubes is able to produce this result. The tubes are of so small a calibre, that, even when distended to their utmost, the equality and evenness of the surface remains unbroken. The increase of the fibrous tissue ultimately takes place throughout the whole organ, surrounding the malpighian bodies by thick capsules, and by its contraction variously narrowing the tubes and cutting them up into cysts. Such tubes as remain open are apt to be affected by the morbid changes which have commenced external to them.

The disease is closely analogous to cirrhosis of the liver, and has its seat in the intertubular fibrous tissue.

These disorders, the tubal and the intertubular, are essentially and primarily renal; they originate in the kidneys, and such other changes as are associated with them are the consequences of the defective action of the gland which these alterations have produced.

of vessels; waxy, amyloid, or depurative disease.

The third form of disease, which must be included under the general term 'Bright's disease,' differs from them in being the result of a general change, which involves the kidneys in common with other organs. It has its origin in the minute blood vessels, though not ultimately limited to them. It has been described as waxy, or of late, as amyloid, degeneration. The kidneys, like the other glandular organs, become infiltrated with a glassy material, which is poured out of the minute arteries, and spreads itself throughout the whole tissue. The organ first has simply a whitish or anæmic look, it increases in hardness and in bulk, and often assumes, in consequence of the prevalence of the new formation, a translucent, or 'waxy' aspect. The capsule, as the disease goes on, becomes thickened and adherent. After more or less increase of size, shrinking takes place, owing to a contractile power in the new formation, and the surface becomes uneven and puckered. The grand characteristic of the change is in the action of iodine, which imparts to the new deposit a dark brown colour, unlike the yellow tint which the healthy parts of the gland receive from the same reagent. The peculiar reaction does not take place in any other form of renal disease, and depends upon the chemical condition of the new matter which is poured out into the interstices of the organ. It will be shown, hereafter, that the infiltration of this peculiar material occurs especially when the system has been exhausted by a long-continued discharge of pus; and hence the term *depurative* has been proposed as a substitute for the unsatisfactory terms hitherto in use.

Each of the three forms of disease which have been sketched will require separate consideration. They affect different periods of life. They arise from totally different causes. They give rise to dissimilar symptoms. They are unlike each other in their course, in their tendency to recovery, and in the treatment they require.

Examination of the Kidney under the Microscope.

A few words upon the mode of examining the kidney microscopically may be of service.

Epithelium.

The state of the epithelium is best shown by scraping the cut surface, and placing a minute portion of the *débris* gathered on the knife, with a drop of water, under a quarter or eighth object-glass.

Tubes.

By this plan, tubes are often detached also, but these structures are best displayed in a section. To obtain this a double-bladed knife may be used; but the best way is to expose a small piece of the organ—a cubic half inch—to the action of a mixture of ice and salt, by which, in about a quarter of an hour, it becomes perfectly hard, so that sections of any degree of tenuity can be cut with a sharp scalpel or razor. Sections made in this manner are adapted to show the effects of reagents, indigo, iodine, &c.

Boiled sections.

This plan will also show the fibrous tissue, but it is found that the intertubular structures and the attachment of the capsule are seen with more distinctness in the smoother sections which can be made from portions hardened by boiling or by chromic acid. A small piece of the kidney boiled for a few minutes in water slightly acidulated with acetic acid, and then allowed to dry, affords transparent and beautiful sections. (See Med. Chir. Trans., vol. xliii., Plates 7, 8, and 9.) A level surface may be cut with a razor, a drop of water put upon it, and a section removed which includes the moistened part.

This plan is ready, effective, and suited to those who wish to economise their labour.

Chromic acid sections.

Better results are, however, obtained by hardening a piece of the organ in chromic acid, and making transparent sections therefrom after the method introduced by Mr. Lockhart Clarke. A piece of kidney of the requisite size is allowed to remain for two or three weeks in a solution of chromic acid in water, in the proportion of about 2 grs. to 1 oz. This makes it hard, and fit for manipulation. With a razor the blade of which is kept wet with spirit, beautiful sections can be cut, from the resistant mass. The sections, however, are too opaque to show well unless they are very thin.

The next step is to make them transparent, and at the same time to impart a little colouring matter. The sections are first left for a few minutes in water so as to remove all traces of spirit. They are then placed in a weak solution of carmine and left there until they have taken a faint pink tint. They are then put again in water, so as to remove all excess of colouring matter, and are thence transferred to spirit. When they have become permeated by the spirit they must be removed to turpentine. A small quantity of turpentine should be put in a saucer or evaporating dish, or any vessel with shelving sides. The sections should be ranged around the fluid, so that a corner of each touches its surface: the result will be, that in each section the spirit will evaporate from above, while the turpentine rises from below, and after a time the section will be saturated with the latter fluid, and will assume a remarkable translucency. When the section is thoroughly imbued with turpentine, the object of this apparently complicated process is obtained. The several steps are needed in order to replace the water in the tissue by spirit which is more volatile, and to replace the spirit by turpentine, with which it is not miscible. With regard to the colouring with carmine, precautions are necessary to avoid the contact of spirit with that pigment. When the sections are perfectly translucent, they may be put up in Canada balsam, and will remain imperishable memorials of the patient from whose body they were obtained. (See plates 5 and 9.)

The beauty and clearness of the sections obtained by this method leave nothing to be desired. The plan is applicable to many other structures.

circumstances, the same transudation may be poured into the tubes from the capillaries which lie outside them.

Change in arteries.

2. In the second place, there is a change in the vessels themselves, which occurs as the essential element in the 'amyloid or depurative disorder, in virtue of which they become unnaturally permeable to the fluid part of their contents. The fluid part of the blood, liquor sanguinis as it is called, holding albumen and fibrine in solution, appears to transude, under such circumstances, from the affected vessels, wherever they may happen to be. Such a transudation takes place into the solid tissue of the liver and spleen, from the surface of the stomach and bowels, and in many other situations. The effusion may be so placed as to furnish materials for growth within the interstices of solid organs, or may pass as a discharge from a free surface. The position of the affected vessels determines the result. The malpighian vessels hang loose and free, so that any exudation from them passes into the tubes and mixes with the urine, while the same emanation from the intertubular vessels passes into the interstices between the tubes, and may give rise to new fibroid growth in that situation. When the change happens to affect the malpighian arteries, the escape of liquor sanguinis will, as one of its results, necessarily render the urine albuminous.

Or a denuded state of tubes.

3. In the third place, it is found that there is a diseased condition of the renal tubes which generally co-exists with highly albuminous urine. The tubes consist, in health, of a simple membrane, immeasurably thin, upon one side of which are capillary blood vessels, on the other side epithelial cells. This is the type of all glandular structure. It is probable that the fluid part of the blood can readily permeate the simple walls of capillary and tube, and thus is brought into contact with the epithelial cells. In the epithelial cell lies the power of the gland. The cell acts after its kind upon the fluid presented to it by the basement membrane, and, by the exercise of its function selects and rearranges the materials which are to form the secretion. When the epithelial cells are removed, the fluid of the blood, having traversed the homogeneous membranes, can pass into the tubes without hindrance or modification.

Such, then, increased determination of blood to the organ, textural changes in the vessel walls, and loss of the protective epithelium of the tubes, are the immediate circumstances which occasion the mixture of albumen with the urine. Sometimes one may act singly, or any two may co-operate, or all may be conjoined in the same case. How these abnormal conditions arise will appear in the following pages.

Casts.

Like albumen, derived from liquor sanguinis.

What has been said touching albumen applies also to fibrinous casts. Fibrine and albumen equally belong to the liquor sanguinis. When from any of the circumstances which have been described the fluid of the blood enters the urinary tubes, it is only the serous portion which can escape as fluid. The fibrine will solidify as soon as the blood has escaped from its proper channels, and will reach the urine in a solid form. It appears that in most cases the fibrine is separated in the tubes, which act as moulds to the nascent material, and impress it with their size and shape. Whatever matters the tubes may contain will become imbedded, so that according to the nature of the case the fibrinous cylinder may include epithelial cells in diverse conditions of health or disease, pus globules, blood discs, &c.

Moulded in tubes.

Imbed their contents.

Sometimes it is possible, in a carefully prepared section, to trace the fibrinous casts quite up the tube to the position of the malpighian body. In such cases there can be little doubt that they are produced by the consolidation of fibrine which escapes along with albumen from the arterial tuft.

There are other cases in which the casts appear to be derived from the denuded walls of the tubes, or even under the influence of congestion from the walls of tubes which are merely the seat of disturbed epithelial growth.

Come from two sources.

Occasionally there is evidence of the escape of fibrine in two different parts of the same urinary channel. Casts of large diameter are seen containing within themselves others of smaller size. In such cases the small cast has been formed in the upper, or convoluted part of the tube, probably of fibrine which has escaped from the malpighian vessel. While pursuing its course towards the exit it has reached a wider channel, from the walls of which fibrine is poured out in sufficient quantity to surround and imbed it in a larger cylinder. In cases where I have seen such double casts in the urine I have found after death that the outer investment has evidently been supplied by the straight tubes which have been dilated and bared of epithelium, and have contained large fibrinous plugs. (See plate 3.)

Epithelial casts.

Pus casts.

Though as a rule fibrine forms the basis of urinary casts, and often is their only constituent, yet it sometimes happens that cylinders are found in the urine which appear to consist entirely of compacted epithelial cells, or of epithelial cells held together by fibrine so small in amount as to be barely perceptible. Not only do epithelial cells enter into the composition of casts, but, as has been stated, casts may contain anything which traverses the tubes. They therefore give an insight into what is going on in the gland, while by their diameter they show the calibre of the cavity in which they were moulded. If epithelial cells are imbedded, there is a catarrhal or inflammatory state of the tubes, which promotes the growth and detachment of cells. If pus cells are included, the inflammatory or catarrhal state has taken such hold of the tubes that the epithelial cells are replaced by pus globules. Blood globules will show that there has existed enough congestion to rupture the malpighian capillaries.

Granular casts.

Amorphous granular matter will vary in its indication, according to its origin. It appears that such granular matter is of two kinds, one sort produced by the breaking up of detached epithelial cells, and generally associated with a late stage of tubal inflammation; the other sort belonging to granular degeneration, and apparently consisting of comminuted and altered fibrine.

Diameter of casts.

The diameter of the casts will give indications of a certain kind. If the casts are of small size, not more than $\frac{1}{1000}$ of an inch in thickness, they have come from tubes which retain their epithelial lining. If they are of large size, $\frac{1}{500}$ or thereabouts, they have been moulded in tubes which have lost their epithelial lining. If of larger size still, they may even be nearly double the width last mentioned—they have come from tubes which, in addition to the loss of their cellular lining, have become dilated. Casts of the largest sort may be always regarded as having been formed in the straight tubes, while the smaller varieties may come from the straight or convoluted tubes indifferently.

CHAPTER III.

PATHOLOGY OF TUBAL NEPHRITIS.

It appears that, as regards inflammation of its secreting structure, the kidney bears an analogy with the mucous membranes, especially with such as are bestowed in a tubular form. When the bronchial membrane is inflamed, if the disease be violent enough to destroy life in a short time, we find that the membrane is injected, and that the tubes contain an excess of secretion, which is more or less altered from its natural state. If the patient die later in the disease the excess of vascularity is less evident, and but for the alteration in quantity and character of the fluid which the tubes contain, there is no very legible record of the morbid action which has proved fatal.

Change limited to tubes.

In the kidney the inflammatory change is also strictly limited to the inner surface of the tubes, and the product of inflammation, as in bronchitis, is an excessive growth of epithelium, of which the cells may be natural, or may, particularly if the disease has lasted any time, be changed in several particulars. They may become fatty, or may become changed into pus globules. The narrowness and contortion of the secreting tubes renders it very difficult for the epithelial growth to make its way out, when, as in this disease, it is superabundant. The consequence is that the ducts become packed to distention, and the organ is proportionally increased in size.

It will be convenient to consider the morbid anatomy of the disorder first in its acute, and then in its chronic form. It is not always easy to make the distinction, for the changes are the same in their nature in either case, although the well-marked examples of each sort are sufficiently unlike each other.

ACUTE TUBAL NEPHRITIS.

Acute form.

The inflammatory action, in its early stage, is accompanied by a great increase of blood in the gland, which becomes perhaps more than double its usual weight. The surface remains perfectly smooth, but there is a remarkable increase of vascularity. The vessels which divide the surface into lobules, and in health are but faintly seen, become intensely injected, sometimes so as to give an almost uniform redness to the surface. The stellate veins which are seen in a later period of the disease are as yet absent. The capsule is loose and thin, as in health. On section the inside presents a red or chocolate colour, and drips with blood. The pelvis is injected. Underneath the blood by which the tissue is obscured, a light-coloured or buff deposit exists, which does not belong to the healthy kidney. This becomes more evident when the surface has been washed. The malpighian bodies stand out as red dots. It may happen that though the disorder be no less acute, the congestion will be less conspicuous than the increase of bulk. The colour may be whiter than in health, though the cut surface exudes blood freely, and the whole organ is obviously injected. But the vascularity is masked by the opaque white epithelium which distends the tubes; and the cortex, which is greatly increased, looks as if it consisted of two materials: a red and a buff, coarsely intermingled. The cones are less changed than the cortex, being simply congested. Plate 1 represents a kidney in an early stage of nephritis, the result of scarlatina.

Kidney enlarged and injected.

Under the microscope the cortical tubes are seen to be stuffed with an opaque brown material, which so long as it remains in the tube does not display any structure, but looks uniformly granular. Spread out on the glass it is seen to consist of cells of epithelium, not changed excepting that they may be stained of a brownish colour, beside blood corpuscles and indefinite granular matter; the latter probably resulting from disintegration of the epithelial cells. This condition is most marked in the convoluted tubes, but the straight usually contain more or less of the same material. Beside the cell growth, there is usually fibrinous exudation in the tubes. In some cases (Vallance, p. 69) this is very abundant.

Tubes stuffed with epithelium, granular matter, and fibrine.

The malpighian bodies stand out prominently, and their vessel is seen to be distended with blood corpuscles. There are no other changes in the organ. The tubes are everywhere in contact with each other. There is no interstitial effusion, and, excepting the distention of the tubes and blood vessels, the organ is natural. The disorder—the desquamative nephritis of Johnson—is essentially a renal catarrh. It depends upon a too prolific epithelial growth, not upon any change in the nature of the cells, which, taken singly, present no tangible departure from their normal state.

The variations in the appearance of the organ depend upon the relative proportions of blood and of epithelium. It seems that the more congestive varieties are produced by exposure to cold, while those in which the epithelial formation is most evident are generally due to scarlatina (see plate 1). In the latter case the tubes contain little or no blood, but a profusion of natural gland-cells, with some granular material, probably derived from a breaking up of others.

It may be, if the attack is recent and slight, such as often occurs in the course of continued fever or diphtheria, that unless looked at with some care nothing might be noticed but that the cortex is more bulky than usual. The kidney is thick, heavy and rounded. The cortex often shows a sort of coarse grain, as if a buff-coloured formation had been packed in a minute vascular network.

Tendency to recovery.

The disease has a natural tendency to recovery. The vascular excitement in which it commences usually depends upon some transient cause, and will subside as it expends itself in secretion, if the circumstances are such that free epithelial growth can take place. This process, however, in the kidney is fraught with peculiar danger, from the narrowness and winding disposition of the ducts. Should the disorder persist it will be from the plugging of these channels. This will remain after the early congestion has passed off, and the appearance of the diseased organ will be modified accordingly.

CHRONIC TUBAL NEPHRITIS.

The kidney no longer drips with blood when cut open.

More chronic form; great increase of weight; whiteness.

In the more serious and confirmed varieties of the complaint there are two conditions which strike the eye. Increase of bulk and change of colour. The weight is often more than doubled. The secreting structure has a peculiar opaque whiteness, or a pale buff colour. When white and ivory-like the epithelium will be found natural; when with a yellow shade it is fatty. The surface is perfectly smooth and glossy, and the capsule readily slips off. The fine network of capillaries which belongs to the surface in health has disappeared and is replaced by red blotches of vessels disposed in a stellate form, large enough to be followed by the naked eye. On section the pallor of the cortex often contrasts with the cones which retain their normal tint; though sometimes the latter are paler than natural, owing to an extension of the same change as has affected the rest of the organ. The cones are separated from the capsule by an increased thickness of cortex, and are sometimes compressed into the shape of a wheat-sheaf. Unless fatty change have taken place the gland is harder than in health.

Cysts do not occur as the consequence of this disease.

Disease limited to tubes

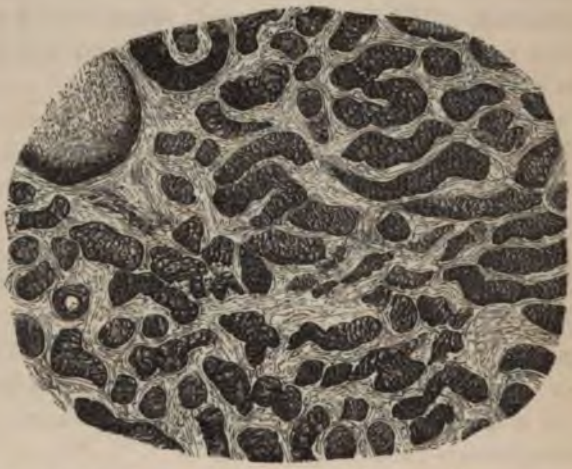
In whatever way the microscopic examination of such a kidney be managed the result is the same. If it be picked to pieces and looked at with a high power, numbers of distended convoluted tubes will be seen. They contain the epithelial cells either natural in character or fatty, and generally a proportion of them will be found to be broken up into a granular débris. Fibrinous exudation is often present.

It was found that in an examination of 27 kidneys affected by this disease that the epithelium was free from oil in 10, slightly fatty in 4, generally fatty in 13.

Their contents.

The straight tubes present some variety. Some, like the convoluted, are generally packed with the products of epithelial growth, while others contain transparent fibrine. In the earlier stages this transparent effusion, which has probably come from the malpighian body, is contained inside a natural epithelial lining, while as the disease advances the cells disappear more or less completely, leaving the tube, which now consists only of naked basement membrane, filled with large transparent plugs.

If a section has been cut from a portion of the kidney previously frozen it will be seen that all the structures of the organ are unaffected by disease, save only that the tubes are distended. Sometimes all the tubes seem to have suffered alike, so that the whole surface exposed is uniformly covered with dark swollen tubules. Sometimes the distended tubules are more numerous near the surface than in the deeper parts, or they may occur in little isolated masses, lying among the natural structure.



Obstruction of tubes by epithelium, in nephritis of a month's standing; from a child six years old. A malpighian body is seen in the corner.

In a section which has been made after boiling precisely the same results are reached.

Other structures unaffected.

It may be added that other methods of displaying the structure of the organ, as for instance hardening in spirit or in chromic acid, give precisely the same information, though the most satisfactory methods of obtaining sections are those alluded to.

Sometimes the tubes are so evenly filled that but for a loss of transparency the section might be looked upon as natural. Generally some tubes are filled more than others, and appear dark and opaque. Perhaps here and there a coil may be seen tinted with blood. When the epithelium is fatty it often happens that the distention is limited to certain families of tubules which in the cortex show as dark patches among the rest, while in the cones the distended ducts are displayed as dark streaks. A section of a kidney affected as described is shown, plate 2.

Excepting malpighian capsules.

No other parts of the gland are affected. There is no increase of the fibrous tissue. The capsules of the malpighian bodies are thin, as in the natural kidney. They are sometimes however altered in one respect. They may become dilated by the accumulation of their contents, consequent upon the obstruction in the tubes. This dilatation does not attain to anything like the extent sometimes observed with granular degeneration; the stoppage of the tubes is not so complete. There is no thickening around any of the blood vessels, nor any intertubular spaces visible under the capsule or elsewhere. None of the tubules are changed, save as regards their contents—none are constricted from without, as in the granular kidney.

Kidney large and smooth to the last, unless complicated with depurative change.

With the absence of intertubular deposit there is an absence of superficial granulation. This alteration of surface only occurs when the intertubular structures are the seat of disease. The large smooth kidney of tubal inflammation generally remains large and smooth to the last. An exception to this rule takes place when the amyloid or depurative change is superadded, bringing with it gradual loss of bulk, and sometimes sparse depressions of surface.

It appears to be by means of this alteration, until lately but little understood, that the 'small smooth kidney' is generally produced. If, in simple tubal nephritis, the loss of the contents of the tubes ever suffices to reduce the once enlarged kidney below its natural bulk, such a result must be of rare occurrence, since no unequivocal instance has fallen under the observation of the author.

Fatty Degeneration.

A fatty condition of the renal epithelium has attracted much attention. As already stated, the epithelium frequently becomes loaded with oil as a consequence of tubal nephritis; especially when that disorder has arisen in consequence of exposure to cold. If the change is extensive and of some standing it gives rise to a striking peculiarity in the appearance of the organ. The outside still remains smooth to the touch, but is closely sprinkled with little white sharply defined specks, like bits of bran. They have a broken appearance, and their white colour forms a contrast with the yellowish cortex, through the whole of which they are interspersed. This appearance is characteristic of a great amount of fatty change in the accumulated epithelium. The specks are aggregations of fat within the tubes. (See plate 2.)

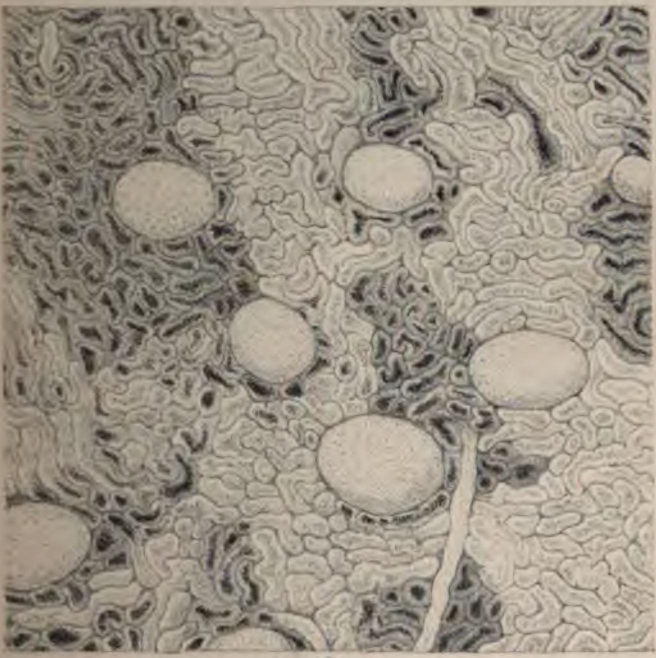
Fatty degeneration of epithelium.

Where the epithelium has become fatty to a less degree it is often difficult to detect the change without microscopic examination. The only difference evident to the naked eye is a somewhat yellowish shade over the cortex, and a coarseness of texture which contrasts with the close fine grain seen where the epithelium is unchanged.

It will be seen hereafter that when the renal disturbance has come on after cold, fatty change is the rule; when after scarlatina it is the exception. There can be no doubt that the importance of this alteration has been much exaggerated. It is not the primary change, but is the result of an altered state of nutrition of the cells consequent upon the inflammatory state.

Though rapidly produced it is never seen in the very

Plate 2.



Magn^{d} 75 d.

Tubal Nephritis: partial obstruction of tubes.

See description of Plates

Tuffen West del. & sc.   W. West imp

earliest stages of the disease. It may be found, however, within a few weeks of the outset, and may prove fatal within six weeks, though usually more protracted.

The change certainly takes place independently of any similar alteration in other organs; it is simply the result of a local condition. As in the liver, it by no means indicates a hopeless state of disease. The epithelium, for a time fatty, may recover its natural characters. The only fact I have been able to associate with this state is that it arises in the great majority of cases when the disorder has been traced to cold and exposure. I found that of nine grown persons who had died with the kidney in this state, three were known to have been given to drinking, but, since the condition is found in children, it is hardly possible to assign much importance to this coincidence. It agrees with all our experience in pathology to find oil produced in tissues altered by inflammation.

Considering how much more the kidneys are congested when cold has been the cause of the disorder than when it has followed scarlatina, we may surmise that the alteration is simply due to the greater intensity of inflammatory action in one case than in the other.

Such is a general sketch of the pathology of the enlarged smooth mottled kidney. It will be easy to add from time to time such particulars as belong to the several varieties of the disease. It will be observed that I have included the fatty and the non-fatty in a common description.

CHAPTER IV.

CLINICAL HISTORY OF TUBAL NEPHRITIS.

It may be well to consider, first, the conditions under which persons are likely to be attacked; and, secondly, the immediate causes which give rise to the disorder.

Sex.

It appears that of the adults which are the subjects of it, more than twice as many belong to the male as to the female sex.

Tubal nephritis affects chiefly male sex,

In childhood this inequality is less. Dr. Miller, in his Treatise on the Kidneys in Scarlatina, has given the details of 66 cases where the disease arose from scarlet fever. His patients, with one or two exceptions, were children; 35 were male, 31 female. I have obtained from my own practice, and that of my colleagues at the Children's Hospital, the notes of 61 cases of the disease. 37 of these occurred in boys, 24 in girls. This includes cases of the disease from all causes.

Dr. Tripe, who has given some most comprehensive papers on scarlatinal dropsy,* assigns the proportion of males to females as 60 to 39.

I find that out of 16 cases in persons over the age of 16, under my own observation, where the disease, arising from various causes, ended in death, only 3 were in females.

Hence, it must be inferred that the disease is most common in the male sex at every period of life, and that the inequality is greatest in adult years. Possibly this may be partly due to the more frequent exposure to weather, and the more liberal use of intoxicating drinks in men than in women.

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* Brit. and For. Med. Chir. Review, 1854.

But the fact that the difference exists in children where the habits of the sexes are the same, is enough to prove that the masculine gender is a predisposing cause.

Age.

And early life.

The disease is essentially one of early life, though perhaps no period can claim a total exemption. It is nearly unknown during the first year, rare in the second, afterwards common. The frequency with which it happens in children as the consequence of scarlatina, or cold, must have struck every one who is familiar with children's diseases. As to its occurrence later in life, it may be stated to be rare after 40, almost unknown after 50. I have never known of a case fatal after the last-mentioned period.

Taking the cases at a general hospital, St. George's, I found that of 30 fatal cases which happened under my own observation at that institution, in which the kidneys were examined microscopically, so that there could be no doubt of the nature of the disease, the ages were thus distributed: 11 died during the first 10 years of life, 5 during the second, 7 during the third, 4 during the fourth, 3 during the fifth, while after 50 none occurred. This evidence may be taken as trustworthy, for though the number of cases is small, each has been carefully examined. Much the same results were obtained from the analysis of a much larger number of cases extracted from the hospital records.* The prevalence of the disease during the first ten years of life depends upon the frequency of scarlatina in that period. Thus there are two periods of life which are especially amenable to the disease. The scarlatinal form is most common under 10 years of age; the form which results from cold is especially apt to occur between 20 and 30.

Predisposing Causes.

The evidence here is entirely negative. Nephritis seems to happen with perfect impartiality in obedience to external circumstances. I have examined with some care the evidence which exists as to any relationship between this disease and the tubercular diathesis. The rarity with which phthisis co-exists is such as to lead to the belief that there is no connection whatever between them. Of 29 fatal cases tubercles were found in the body in 4. Regarding the question from another point of view, I examined the details of all the cases of phthisis examined in the post-mortem room of St. George's for a term of five years. They amounted to 244. In only 17 were the kidneys described as large, smooth, and mottled; and in the present state of our knowledge, we cannot but conclude that most of these were of the waxy or 'amyloid' variety.

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* See paper in Med. Chir. Trans. vol. xliv. p. 171.

No association with tuberculosis or gout.

As to gout, which so often accompanies the granular kidney, it is almost unknown as associated with nephritis. In the 106 cases from the post-mortem books, gout is mentioned only once, and then in a doubtful manner. Gout, however, leaves so little behind it, that it may easily escape notice in the account of a post-mortem examination. I therefore examined the clinical notes of 29 fatal cases of this disease, which had been under my own observation during life, and where particular regard had been had to this question. There was no mention of gout or rheumatic gout in any one.

We may conclude, therefore, that neither tuberculosis nor gout predisposes to tubal nephritis.

Exciting Causes.

This disorder has a character which is peculiarly its own. It is never forgetful of its parentage. Its course appears to be closely regulated by the nature of the cause from which it has sprung. From this circumstance, the clinical history of the disease can scarcely be satisfactory without consideration at the same time of the particular incident which has set it going. It will, perhaps, be well to give first a simple enumeration of the several causes from which the disease springs; then a general sketch of the symptoms which may happen in all cases; and afterwards to revert to each particular source of the disorder, describing its mode of action and the consequent course of the symptoms with as much detail as may be needful to make the account complete.

Renal irritants formed in the body, or introduced from without.

It may be generally stated that tubal nephritis arises from unnatural stimulation of the kidneys. The blood is charged with material excessive in quantity or unnatural in quality, which these glands take upon themselves to remove. Their own proper elements of secretion are poured upon them in sudden and excessive amount, or matter is thrown upon them which is foreign to their usual habit. As a consequence of overwork, or of work to which they are not adapted, they take on a turbulent and abnormal activity. They become congested, the tubes get choked up with epithelial growth, and the disease is established.

The causes of tubal nephritis may be thus enumerated.

1. Circumstances which throw upon the kidney the work of other glands:—Cold to the body, by checking perspiration; obstructions to the escape of bile; destruction of one kidney, by throwing double work on the other (?).

2. Diseases which develope a material which acts as a renal irritant:—Scarlatina, measles, diphtheria, erysipelas, typhus, pyæmia, pneumonia, cholera (?) acute rheumatism (?).

3. Matters taken from without which act as renal irritants:—Turpentine, alcohol, cantharides, arsenic, &c.

SYMPTOMS.

In acute form.

The complaint begins in a definite manner, and can almost always be traced to its cause. The symptom which commonly first attracts notice is œdema. At the same time, the urine is darker, and in smaller quantity than usual, and there is probably pain in the loins. The following is a sketch of the disease in its most acute form. A man approaching middle age has been working hard, and while sweating freely is exposed to cold. Within a few hours he may become 'ill all over,' with shivering and headache. Soon his face, particularly about the eyes, becomes puffy, and œdema spreads quickly over the whole body. He now has a dull pain or feeling of weight in the loins, and the urine has nearly stopped. Perhaps only a few ounces are passed in the twenty-four hours of urine, which is black with blood, and loaded with a dark sediment, which to the eye appears like fine powder. The pulse is hard and full, the skin hot and dry, the tongue coated, the face flushed. There is total loss of appetite, and perhaps vomiting. The older writers often describe such a state of things as acute or inflammatory dropsy, and with truth, though the inflammation is not, as they supposed, diffused over the areolar tissue, but is limited to the kidneys. If the renal mischief be very intense, the urine may be reduced to 2 oz. or 3 oz. a day, and that deeply tinged with blood. This condition cannot last long. If the secretion do not speedily increase, the patient will be poisoned by the elements of the urine which are kept in the blood. He will become comatose and die. The kidneys, supposing the disease to have attacked a person previously healthy, will be found to be in the state described as belonging to acute nephritis. They will be gorged with blood, greatly increased in bulk, and with an evident deposit showing through the general congestion.

Sudden outbreak of dropsy.

More commonly, however, the patient will not die so early in the disease. The quantity of urine will gradually increase, though still remaining below the natural standard. The dropsy will gain ground, involving the serous cavities, and death will take place in a month or six weeks, with coma preceded or not by epileptic seizures. Or it may happen that he will be cut off by acute inflammation of the lungs, or of one of the serous membranes.

If the disorder take a favourable turn, the urine will increase in quantity until it exceeds the natural amount. The dropsy will, at the same time, subside; the albumen will at length cease to be perceptible, and the patient will be convalescent, though left in a very anæmic condition.

More chronic variety.

It is, however, the exception for tubal nephritis to occur in this rapid and active form. In the majority of cases the disease, though beginning with marked and definite symptoms, and in consequence of a clearly ascertained cause, travels with slower steps. The urine becomes dark and scanty, there is dull pain in the loins, and œdema begins in the face and gradually pervades the whole body. The dropsical effusion varies directly with the diminution of the urine and the obstruction in the tubes. It extends into the peritoneum, then into the pleuræ, and lastly into the pericardium. Under this more ordinary and slower form of the disorder, anæmia is conspicuous, while febrile symptoms are slight, or altogether absent. Patients thus affected may sometimes be distinguished at a glance from the other inmates of a medical ward. A man under the middle time of life, with a pallid, puffy face, who sits up in bed, using his arms as supports whereon to elevate his shoulders, may be, without much fear of mistake, put down as labouring under this form of renal disease. And it may be predicted of him, also, that the pleuræ are the seat of serous effusion.

Dropsy.

Œdema of larynx.

Among the dropsical symptoms which follow from this disease may be mentioned œdema of the larynx. This is a rare occurrence. It has not fallen within my own experience to see a case of this kind. Probably some of the cases of 'albuminuric aphonia' which have been recorded have been cases of simple laryngitis, in which the urine has become temporarily albuminous, as a consequence of the laryngeal affection. Other cases have been recorded, in which the upper parts of the tongue, the arytæno-epiglottidœan folds, and the sub-mucous areolar tissue above the vocal chords, have become infiltrated with serum, as a part of general œdema, such as follows scarlatina or exposure to cold. Sir Duncan Gibb mentions such a case in a child of two-and-a-half years old. Dr. Fauvel,* in a paper upon albuminuric aphonia, records several instances of the same affection, in one of which tracheotomy was performed with a favourable result. It appears in these cases that the œdema produces a pale swelling, beginning with the mucous folds above the epiglottis, and passing downwards. There is neither cough nor expectoration. The chief symptoms are alteration or

Albuminuric aphonia.

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* Dr. Fauvel, Compte-Rendu du Congrès Medico-Chirurgical de Rouen, 63, p. 33. Gibb on the Throat and Windpipe, 2nd edition, p. 282.

loss of voice, difficulty of breathing, sometimes with orthopnœa.

Liability to inflammation of serous membranes, &c.

A less frequent occurrence than the dropsy, but one which more often causes the death of the patient, is acute inflammation. This is most prone to attack the serous membranes, the pleura and pericardium more often than the peritoneum. The substance of the lungs, also, is sometimes affected, but not so often as the serous investments. Bronchitis is comparatively rare.

And in children of the organs of respiration especially.

With children, acute inflammation of one or other of the organs of respiration is the most fatal tendency of the disease. Not only are they liable to pleurisy, pneumonia, and bronchitis, but diphtheria and croup sometimes occur.

Erysipelatous inflammation often attacks the dropsical limbs, though it is to be feared that this is as often the result of injudicious treatment as of the natural tendency of the disease.

Vomiting may happen at any stage, even the earliest; it is often incontrollable. Diarrhœa, on the other hand, seldom occurs, and then is not a source of danger.

Head symptoms, generally convulsive.

The head symptoms which occur in this more prolonged form of the complaint are usually of a convulsive kind, whereas when the disease is of the more acute form first described, coma is apt to set in without any such prelude. The epileptic seizures sometimes come on without any premonitory sign, or they may be preceded by pain in the head, drowsiness, or peculiarity of manner. The convulsive seizures may be repeated in quick succession, and then pass off without any further mischief, or they may give place to a condition of incomplete coma which is apt to end fatally.

Anæmic state of brain.

The occurrence of any of these symptoms appears to depend on the co-operation of two causes—an anæmic state of the nervous centres, and their impregnation by uræmic poison. Post-mortem examination shows the brain, especially in adults, to be pale and watery. Even in cases where much heat of the head has suggested congestion within, it is found after death that the contrary condition exists. It is generally believed that violent convulsive attacks necessarily cause congestion of the brain; but the fallacy of this belief is shown by the facts observed in this disease. The brain is found to be deficient in vascularity, though convulsions have been repeated with violence almost until the moment of dissolution. With children it often appears that the convulsions are associated with some inflammatory state such as pneumonia, the brain being consequently congested. Continued vomiting appears to act as a forerunner of the convulsive attacks. If a patient, particularly one past childhood, be much exhausted, especially by vomiting, it may generally be predicted that uræmic convulsions are at hand. Much as children are liable to convulsive seizures during the course of other diseases, it appears that with the disorder under consideration they are less liable to be affected by head symptoms than grown people. This may perhaps be attributed to the more rapid course of the complaint in children. A certain time is needed for the production of the general anæmia, and the requisite amount of uræmic infiltration. Adults who are less liable to be cut off by inflammatory attacks, and who at the same time are less likely to make an easy recovery, suffer from what may be considered the ultimate dangers of the disease.

Attacks less common with children than adults.

From the experience of my colleagues at the Children's Hospital, added to my own, I have been able to collect the particulars of 42 cases of tubal nephritis in children under 12 years old, in which recovery took place. Of these, 5 had convulsive seizures in the course of the complaint.*

Taking fatal cases from the same sources, I find that in 30 cases, convulsions generally followed by coma occurred in 7, coma without convulsion in 1.

Among persons of the age of 16 and upwards, the proportion was found to be considerably greater, convulsions or coma occurring in nearly half the fatal cases. (See table, p. 36.) It is worth observing, in connection with the state of the brain in these attacks, that they almost always occur with dilated pupils; whereas during congestion of the brain the pupils are generally contracted. When the symptoms take a severe form, the attacks occur in quick succession, sixteen or seventeen sometimes happening within as many hours. The patient between whiles is in a semi-comatose state, possibly with slight stertor, but not absolutely unconscious. The pallor of the countenance will often serve as a ready means of distinguishing head symptoms from this cause.

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* I have to thank Dr. West and Dr. Hillier for liberally placing their note-books at my disposal.

Tabular view of symptoms.

The accompanying table gives an abstract of the symptoms which occurred in a series of 39 fatal cases, of all of which were careful notes kept.

Table showing Affections consequent upon Tubal Nephritis in Childhood, and afterwards.

Affection	Under Sixteen, Twenty-three Cases	Sixteen and upwards, Sixteen Cases	Total Number, Thirty-nine Cases
Hæmaturia*	11	7	18
Frequency of Micturition. .	0	4	4
Pain in Loins	1	9	10
Œdema	22	16	38
Ascites	11	9	20
Hydrothorax	7	4	11
Fluid in Pericardium . .	1	0	1
Purpura	0	1	1
Epistaxis	0	1	0
Erysipelas or Abscess . .	3	5	8
Uræmic Convulsions . .	5	5	10
Simple Coma	0	2	2
Other head symptoms . .	4	0	4
Pneumonia	9	1	10
Pleurisy	5	3	8
Peritonitis	2	3	5
Pericarditis	0	1	1
Endocarditis	0	0	0
Bronchitis	8	0	8
Coagulation of Blood in pulmonary artery . .	0	2	2
Croup, or Diphtheria . .	4	0	4
Vomiting	4	5	9
Diarrhœa	2	3	5
Gout	0	0	0

The table has been divided so as to show how the symptoms differ in childhood and adult life. It seems that œdema is almost an invariable symptom, and that ascites and hydrothorax stand next in frequency. Vomiting is characteristic of the disease rather than diarrhœa. Uræmic poisoning is the great danger in the adult; in childhood, inflammation of the respiratory organs. The tendencies of the disease at the two different periods of life will be further considered.

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* Blood evident to naked eye.

Tendency to recovery.

The preceding outline chiefly applies to tubal nephritis where it ends fatally. It must not be supposed, however, that this is its most frequent termination. From whatever cause it arises it has a natural tendency to get well, stronger or weaker, according to the age of the patient, his previous habits, and the source of the complaint. Children will recover in the majority of cases. As resulting from febrile disorder, by far the majority of cases will recover under judicious treatment. When from cold, the recoveries are, as will be presently shown, fewer. Even with the most confirmed and seemingly hopeless cases recovery will sometimes take place. It has sometimes happened to me to see a patient with this disorder, who had been discharged as incurable, come back in perfect health long after I had supposed him dead. Recovery is heralded by an increase in the quantity of the urine, which soon comes to surpass its natural measurement, often to a great degree; at the same time the dropsy is carried off, first from the areolar tissue, then from the serous cavities. The urine may recover itself soon after the dropsy goes, and the patient speedily return to health; or in a less favourable case the dropsy and all conspicuous signs of the disease may subside, while the urine continues albuminous perhaps for years. Casts and renal epithelium can generally be detected after the albumen has ceased to be perceptible.

Sudden attack of Dropsy, with bloody and albuminous urine; recovery.

The following case, which furnishes an instance of recovery from a severe attack of nephritis, is slightly abridged from a paper in the 'Lancet,' Nov. 1861, by Dr. Williams of Swansea. The patient was a medical student, twenty-two years of age, in whose fate, as Dr. Williams tells us, he was deeply interested. If it is allowable to hazard a conjecture, we may guess that the patient whose symptoms are portrayed so faithfully is no other than the distinguished physician who tells the tale.

'At the end of the winter session at one of the London hospitals, at which he had been severely working, and while enjoying his ordinary health, this gentleman was seized in the night with bloody urine, and a frequent desire to pass it. The urine was first observed to be dark in colour, and much reduced in quantity on rising in the morning. His suspicions were excited as to this symptom, and he went to Dr. Barlow, who tested the urine and found upon the addition of nitric acid that it was literally converted into one clot of albumen. Dr. Bright, who was consulted the next day, recommended the patient to leave town for the country, holding out no hope of recovery. Dr. Prout, who was next appealed to, said that the case was one of hæmotrophy of the kidneys, the urine being bloody, of high specific gravity, and highly albuminous. Satisfied now that he had become the subject of Bright's disease, the patient resolved to leave for the country. Neither Dr. Bright nor Dr. Prout would hold out any hope of recovery.

'On the tenth day after the first appearance of the symptoms the patient went into the country. The urine was still scanty, less than three-quarters of a pint in twenty-four hours; the dropsical symptoms every day increased; the urine was as dark as porter, and highly albuminous; the skin was dry and feverish; the breathing was growing in tightness and difficulty. In a fortnight further the body had greatly increased in size, while the urine had scarcely at all augmented in quantity. Convinced that he was going to die, greatly alarmed at the swelling and the difficulty of breathing, the patient determined to resort to compound jalap powder and warm baths, after which a change for the better became evident; the skin began to act, and the urine increased in quantity. Thus he continued for three months. The urine was now more abundant, and contained a smaller quantity of albumen and of blood.

'Under the use of citrate of potash and iron, which were prescribed by Dr. Prout, the improvement continued for six months, at the end of which time the dropsy had entirely disappeared, the patient had become pale and thin, the urine had greatly increased in quantity, and micturation was frequent, both during the day and the night. The urine deposited masses of casts, epithelial cells, oil globules, red corpuscles, and granules.

'The albumen continued to diminish; the urine averaged three pints in the twenty-four hours, was of a slight muddy or smoky tint, and never fell below 1012 in sp. gr. The patient was pallid, nervous, and dyspeptic, but was active in mind and body.

'At the end of two years from the first attack the albumen had entirely disappeared. For three or four years afterwards there persisted a slowly decreasing amount of renal irritability—that is, micturation frequent at night, and the ordinary secretion was rapid and excessive in the day, if at any time a stimulus were taken. After the urine had ceased to contain albumen, the microscope still showed a few casts, cells, and oil globules.

'More than twenty years have elapsed since the patient was downstruck by his attack. He is now in perfect health. The urine has been perfectly healthy for at least fifteen years. He has never experienced the slightest relapse or return of the original symptoms.

'Six years before the beginning of this illness the subject of it had a severe attack of scarlet fever, followed by slight dropsical symptoms.'

Duration of the Disease.

It may be well to give in this general sketch a few facts as to the duration of the disease under different circumstances. The great majority of persons who die of it do so within six months of the outset; it is rare for a fatal case to be protracted as long as a year. When recovery takes place it may be at any time, early or late, so long as the disease remains uncomplicated by 'amyloid' change. It is not unknown for the disease to stretch over several years and to eventuate in recovery. In such cases the albuminous state of the urine long outlasts the more visible symptoms of the disease.

Death within six months.

Recovery at any period.

The time which the disease takes to reach a fatal ending depends much upon age. The younger the patient the more rapid the course to recovery or death. The accompanying table gives the duration of the disease in fatal cases, at the several periods of life, childhood, adolescence and adult-age. It is compiled from the notes of 54 cases, in all of which post-mortem examinations were made, which occurred at St. George's and the Children's Hospital. It will be seen that during childhood the majority of fatal cases terminate during the first month, many within the first week. Few survive the third month, none the fifth. After the age of 20, no

Disease shorter in childhood than with adults.

deaths took place within a week, few within the first two months. The greater number of cases terminate after the end of the second month, before that of the sixth.

Table showing the duration of Fifty-four fatal cases of Tubal Nephritis, arranged according to the age of the patient.

	Under 4 yrs. old	4 to 10	10 to 20	Over 20	Of all ages
Dying within 1 week .	2	4	—	—	6
Between 1st week and end of 1st month .	4	10	1	2	17
In 2nd Month. . .	2	6	2	1	11
„ 3rd „ . . .	—	3	3	4	10
„ 4th „ . . .	—	—	—	1	1
„ 5th „ . . .	—	2	—	3	5
„ 6th „ . . .	—	—	—	3	3
Later	—	—	—	1	1

Immediate Causes of Death.

Before concluding this general sketch of the symptoms of nephritis, it may be interesting to consider the circumstances to which death is generally due. These vary with age; children and adults not only die, as has been shown, at different periods of the disease, but they die in a different manner.

In childhood generally inflammatory attacks.

I have collected the particulars of 40 cases fatal under the age of 16, which were examined post-mortem:—30 from the Children's Hospital, 10 from St. George's; 25 of these owed their death to inflammation of the respiratory organs This number includes 15 of pneumonia; 10 of pleurisy; of which 5 had gone on to empyema; 7 of bronchitis; 5 of croup or diphtheria. In many of the cases, as is evident from the figures, the inflammation was not limited to one structure. Pneumonia in particular was a very constant companion of pleurisy or croup.

15 cases remain to be accounted for. In these, death was caused in 5 by uræmic convulsions, in 3 by dropsical accumulation of fluid in the pleural cavities, in 3 by obstinate vomiting, in 3 by peritonitis, in 1 by sloughing of the scrotum.

Of the age of 16 and upwards, the patients endure the disease much longer and allow it to proceed to what may be considered its legitimate conclusion. They are not cut off by pneumonia, pleurisy, or any other intercurrent affection, but generally live long enough to die of uræmic poisoning, or of one of the direct consequences of dropsy. In these cases, as the disease draws to a close it is usual to find several secondary affections attacking the patient at the same time; it is therefore difficult to assign the fatal result to one alone. If the patient have convulsions, the chances are that he has had obstinate vomiting. If he have extreme dropsy he is too likely to have erysipelatous inflammation or abscesses in the cellular tissue as the consequence of acupuncture.

With adults, uræmia, inflammatory attacks, dropsy, &c.

Analysing 15 cases, fatal in the adult, and selecting the affection to which death appeared to be mainly due, it was found that in 2 only was it produced by inflammation of the organs of respiration, 1 by pneumonia, 1 by pleurisy. In 5 it was due to convulsions or coma, in 4 to dropsy or its effects, as erysipelas or superficial abscess, in 2 to peritonitis, in 1 to pericarditis, and in 1 to coagulation of blood in the pulmonary artery, the lungs being otherwise diseased.

Urine in Tubal Nephritis.

The two great facts connected with the urine in this disease are the presence of albumen, and the loss of quantity. The more scanty the urine, and the greater the proportion of albumen in it, the more intense the disease, a statement which does not hold good with the granular kidney. There is no more promising sign in tubal inflammation than a spontaneous increase in the amount of the urine. At the outbreak of the disease the urine generally, though by no means invariably, contains an amount of blood enough to cause obvious discolouration. When the urine is acid, the blood will give a black or smoky tinge. When the urine is alkaline or neutral, blood gives a pink or red colour. The specific gravity may be generally stated to be much what it is in health. 1019 may be given as the average during the

Albuminous and scanty, sometimes bloody.

Specific gravity.

disease. In the most acute cases, where the urine is very scanty, it may be much above the natural mark; later in its disease, when the secretion has become more abundant, it is often at 1010 or thereabouts. The urine loses its brightness and amber tint, and becomes dull and deficient in colouring matter.

Sediment.

When the urine is allowed to stand, a copious sediment is thrown down, particularly when the complaint is of recent origin. In the absence of blood the sediment will consist of the contents of the tubes. There will be seen multitudes of cells of renal epithelium, which may be natural or fatty; or, instead of anything that can be recognised as epithelium, there may be pus globules, into which the cells have been converted.

Renal epithelium.

Casts.

Secondly, there will be *casts*. These occur in great variety. Some are much more common than others, and some come early, and some late in the disorder.

Epithelial.

Epithelial Casts.—Transparent fibrine, enclosing epithelial cells, or cells packed together into a plug, are found in almost all cases; probably in all, at some time or other. They belong especially to the early periods of the disease.

Granular.

If the epithelium passes off, not in entire cells but broken up, the casts are *granular* in character, often opaque and coarse. These are as truly epithelial in their structure as those where the cells are seen entire and distinct. If the epithelium of the kidney becomes changed by disease, the contents of the casts will vary accordingly, and display fatty cells or pus, as the case may be. The granular casts generally appear in the more advanced stages of the disease, since it is necessary for their production that the epithelium remain in the tubes long enough to become disintegrated.

Or simply fibrinous.

Transparent cylinders of fibrine—small, as from a tube duly lined with epithelium; or large, when from one which has lost its epithelial growth—are often found. These are the 'waxy casts' of some writers. When small, they are apt to be overlooked from their great transparency. They are usually found in this disease, though they are by no

Plate 3

Contents of tubes in Tubal Nephritis

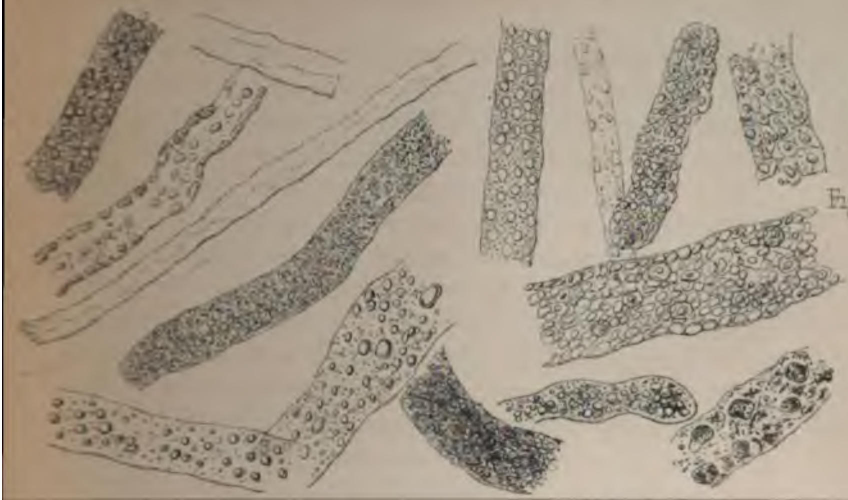

Fig 1

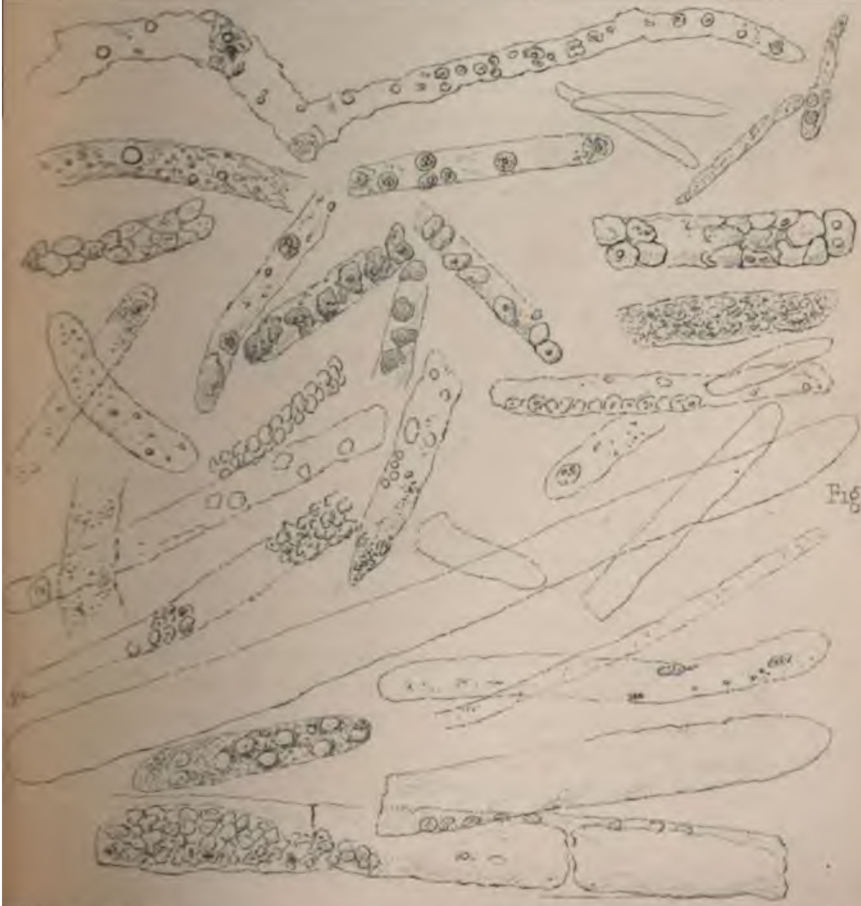

Fig 2

D del. Tuffen West sc.

W West imp.

Casts Tubal Nephritis

means peculiar to it. The small and the large are very distinct in character and in origin. Those of small size may be found, as has been shown, in simple congestion. The large cylinders are definite and distinct; they only occur in the most advanced stages. They sometimes imbed smaller casts in their interior. They come from the straight tubes.

During the presence of hæmaturia, the casts may contain blood corpuscles, or may have a brown colour from being tinted by hæmatine.

Hence, it seems, that judging by the casts alone it would be often impossible to be sure of the nature of the complaint. If, indeed, a quantity of loose renal epithelium were found with many epithelial casts, we might safely venture upon a diagnosis. Casts containing pus globules could scarcely admit of more than one interpretation, but they are of rare occurrence. It must of course be borne in mind, in endeavouring to estimate the condition of the kidney by the microscopic characters of the urine, that it is not uncommon for some amount of tubal nephritis to complicate the course of granular degeneration, or waxy infiltration. In such a case, epithelial casts and epithelial cells will be seen in addition to the deposit belonging to those diseases. (See case of Charlotte Carter).

CHEMICAL CHANGES IN THE URINE.

Chemical changes.

The urine is altered by the addition of albumen, and often of blood, and by the diminution of all its natural components.

Water.—Invariably reduced in quantity, except during convalescence, when it is often greatly increased. When the disease occurs in an acute form, the urine may be reduced in quantity to between 1 and 2 oz. daily. This is the minimum, and only occurs in cases where the tubes are almost universally stopped up with epithelium or fibrine. In the case of Benjamin Patrick, in which the disease followed exposure to cold (p. 60), the urine fell to 2 oz. in the 24 hours. In the case of Vallance (p. 69), in which the attack succeeded to scarlatina, the amount was on one occasion below 2 oz.

Water diminished.

This amount of diminution seldom takes place; it is a most unfavourable omen.*

Diminution to a less extent, the urine being reduced to half or a quarter its natural amount, is of constant occurrence, so long as the disease is stationary or progressing. During the process of recovery the urine is often greatly increased. As the tubes become clear the diuretic action of the retained materials becomes effective, and the secretion may be twice or thrice its normal amount. This spontaneous increase is always a favourable prognostic. The scantiness of urine is in direct proportion to the obstruction of the tubes.

Urea diminished.

Urea.—So long as the disease is stationary, or on the increase, the urea is diminished. The amount generally varies with the amount of water. When the latter suffers the extreme of reduction, the urea is usually reduced to a very small quantity. In a case of fatal scarlatinal dropsy reported by Rosenstein, the urea fell as low as 1·4 grammes in the 24 hours. The patient was a girl 15 years of age. In the case of Vallance the urea fell to ·72 grammes in the 24 hours, probably not a twentieth of the normal amount.

This extreme diminution is a symptom of the worst import, and is usually followed by nervous disturbance—generally convulsions.

In most cases, however, the diminution is more moderate.

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* As a standard of comparison, it may be well to give the mean of the urinary constituents in the healthy male adult. The following amounts for 24 hours are taken from Dr. Parkes' valuable work on the urine:—

Quantity, 1501· C.C., or 52½ oz.
Sp. Gr., 1020.

Urea	33·0	grammes,	or 512 grains
Uric Acid	0·555	„	or 8·5 „
Phosphoric Acid	3·164	„	or 48 „
Sulphuric Acid	2·012	„	or 31 „
Chlorine	8·21	„	or 126 „
Chloride of Sodium	13·6	„	or 210 „
Soda	11·09	„	or 171 „

Potash, varying from 1·7 to 7·6 grammes, or from 26 grains to 107 grains.

In the case of a man who died of the disease after 25 days' illness, the symptoms having been brought on by cold, the urea varied from 15·7 to 8·2 grammes in the 24 hours—from half to a quarter the proper amount.*

In a case reported by Becquerel, in which the patient ultimately recovered, the urea amounted to 11·64 grammes in 24 hours.

In three successful cases of scarlatinal dropsy under my own care I found that in general terms the urea fell to somewhat more than half its proper quantity. In a child of 4 years old, the minimum was 11·25 against 22·25, which it became after recovery. In a child of 7 years old the minimum was 16·5 against 29·92, which it became after recovery. In the third case, a child of 9 years old, the minimum was 15·24, the amount after recovery being 28·0.

In these cases, as is usual during convalescence, the amount of urea was no doubt somewhat above the normal rate.

Uric acid generally diminished; sometimes absent.

Uric Acid.—Though it is not uncommon in this disorder to find a deposition of uric acid, in a crystalline form, or as urate of soda, this appears to result from the scantiness of the urine, not from any excess of the acid. This sediment is particularly frequent with children, and in the earlier stages of the disease. I have never been able to satisfy myself, though it has been so stated, that the uric acid was increased; on the contrary, I have always found it below the normal amount. In some cases it is absent altogether. This happened in the case of Vallance. In the case published by Becquerel the uric acid amounted to ·585 grammes; about the normal quantity.

The method in use for the estimation of uric acid is somewhat uncertain in its results.

Phosphoric acid diminished.

Phosphoric Acid.—The diminution in this acid is more marked than that of uric, but is not so extreme as occurs with other forms of renal disease, particularly with the waxy kidney. The diminution, though seldom extreme, is constant. It is probably owing to the loss of this acid that the urine is so often deficient in acidity. In the case reported by Mosler, already alluded to, the daily phosphates averaged 2·35 grammes, afterwards 1·7 grammes. In three cases o scarlatinal dropsy already mentioned, in which recovery took place, the loss of phosphoric acid was much less decided than the loss of urea. Taking in each case the minimum, and comparing it with the amount after recovery; in the first case, the amount was ·499 against ·89; in the second, ·55 against 1·18; in the third, 1·11 against 1·5.

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* From Mosler, quoted by Dr. Parkes 'On Urine,' p. 379.

In the fatal case of Vallance, it amounted in 24 hours to only ·016, an extreme and exceptional diminution.

Sulphuric acid diminished to less extent than phosphoric.

Sulphuric Acid constantly diminished, but less so than the phosphoric acid. In the case from Mosler, the daily amount of sulphates fell to 1·7. In the case of Vallance, the reduction was less than in the other constituents of the urine, the amount of sulphuric acid in 24 hours being ·212.

Chlorine, always diminished, sometimes absent.

Chlorine.—This constituent is invariably diminished, sometimes totally absent. It is more reduced in this disease than in either of the other forms of albuminuria. The diminution appears sometimes to be exaggerated by the presence of pneumonia, to which patients suffering from this disease are liable. In the case quoted from Mosler, chlorine was on one day totally absent. In the case of Vallance it was reduced to ·017, about equalling the phosphoric acid in amount; the latter being in a state of health in much smaller quantity.

Potash, Soda, and the Earths.—These may be presumed to be diminished, but we have no sufficient data bearing upon them.

Albumen.

Abnormal Constituents.—It is not necessary to say more concerning the presence of blood than has already been advanced. Albumen, invariably present, is abundant. The commencement of the disorder is generally marked by a decided coagulum of albumen in the urine—a fact not observed with other forms of renal diseases. It affords by its quantity a generally correct measure of the severity of the attack. A diminution in the amount of albumen is as favourable a sign as an increase in the quantity of water. The amount of albumen sometimes discharged is so great as to amount to an injurious drain upon the system. The quantity may be stated to vary from a trace up to 35 grammes (more than an ounce) of dry albumen in the 24 hours, but nothing practical is to be gained by an exact estimate of the quantity. The increase or diminution from day to day may be sufficiently ascertained by the rough method of boiling, acidulating with nitric acid, and measuring with the eye the bulk of the coagulum. This varies from a mere cloudiness, such as is noticed during convalescence, to a bulky clot, which in some cases is large enough to convert the whole quantity of fluid operated upon to a gelatinous or solid mass.

Summary of chemical changes.

The chemical changes in the urine of tubal nephritis may be thus summed up. All the constituents are diminished. The water, the urea, and the chlorides, are lessened to a greater extent than occurs in any other renal disease. The phosphoric, sulphuric, and uric acids are reduced in a less marked manner, the phosphoric acid suffering most, the uric acid least. During convalescence, the constituents which have been deficient—the water, the urea, the chlorides, and sometimes the uric acid—are increased beyond the normal amount.

Albumen is invariably present, and in larger quantity than in any other renal disease.

CASES.

The following cases exemplify the general course of the disease when it terminates fatally:—

Tubal Nephritis in a man of intemperate habits—cramp, purpura, pain in loins, general dropsy, urine scanty and albuminous, casts, effects of acupuncture, gradual sinking.

Edward Nash, twenty years of age, a blacksmith, a well-made powerful man, was admitted into St. George's Hospital, November 30, 1858, under the care of Dr. Page.

He said that for seven years he had been in the habit of drinking to excess, having commenced the practice at the age of thirteen.

For the last two years he had been extremely intemperate, drinking beer, gin, and rum.

Six weeks before he came in, being at that time in apparent health, he was attacked with pain in the legs, particularly in the calves, immediately followed by an outbreak of red spots, which were described as resembling purpura. On the next day but one he began to have sharp pain in the loins; and the urine, which had previously always been clear and plentiful, became very dark in colour. Four days later his face became swollen, and the dropsy gradually spread over the whole body, occupying eight or nine days in the process. The pain in the loins now subsided, as he supposed, in consequence of his having been cupped in that situation.

For four or five months before his attack he had been very subject to catarrhal attacks in consequence of exposure to cold, but there had been no definite exposure to which the disease could be attributed.

When he came under observation his face was white and bloated. The whole body, more particularly the legs and scrotum, was highly ædematous. He lay propped up in bed with the right side lower than the left, and it was evident on auscultation that the right pleura contained fluid. There was evidence of fluid also in the peritoneum. There was no pain in the loins, but there was tenderness, especially over the right kidney. The appetite was good and the bowels regular, but he sometimes vomited. The tongue was clean. The pulse weak, 84.

The urine was diminished in quantity and loaded with albumen, the coagulum occupying three-quarters of the tube. It was not coloured with blood, though blood corpuscles were seen under the microscope. There was also a considerable deposit of renal epithelium, some of which was fatty, while some closely resembled pus. Many transparent casts were found, some of which imbedded epithelial cells and others specks of oil.

The frequent use of compound jalap powder, of diuretic medicines including digitalis and of blue pill to the extent of salivation, failed to relieve the dropsy. He was frequently cupped upon the loins with apparent benefit.

On December 8 the scrotum was punctured and much fluid evacuated. Shortly after this it was found necessary to repeat the same expedient upon the legs. The operation was entrusted to a house surgeon, who by way of experiment punctured the left leg with a needle, using a lancet upon the right. Fluid escaped in large quantity. The openings which had been made with the needle healed without any bad result, while those made by the lancet gave rise to deep suppuration, pus being discharged through five of the punctures. The patient became weaker as the discharge continued, and needed stimulants, which were given. Pain in the loins was occasionally complained of. The condition of the urine, early in February, was much as before. It was scanty, acid, and as albuminous as ever, sp. gr. 1019. It contained numbers of fatty cells of renal epithelium. The casts, which in December had contained entire and broken down epithelium, were now entirely composed of transparent fibrinous matter. They were uniform, transparent, and of large size (see woodcut). The fluid in the right pleura had now obviously increased, as had the œdema, and the patient gradually sank without any fresh symptom. He died on February 8, retaining his consciousness to the last. The œdema had latterly been so great that the skin cracked over the legs. The abscess in the right leg had never healed, but had given rise to numerous open sores.

Post-mortem examination.

At the post-mortem examination, the right pleura was found to be distended with fluid in which flakes of lymph floated, while the lung was much compressed.

There was a good deal of sero-purulent fluid in the peritoneal cavity.

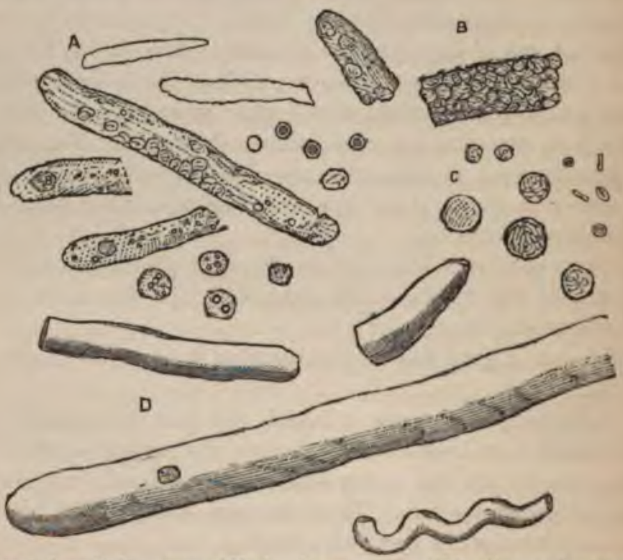
The kidneys were much enlarged, the pair weighing 23 oz. The capsules were loose and thin, the surfaces perfectly smooth and white. On section the cortex and cones were both increased in bulk, the cortex most so. The latter was nearly white, like the surface; the cones of a pale pink colour.

Under the microscope the increase of size was found to be due to distention of the tubes. The section showed that there was no increase of fibrous tissue round the malpighian bodies or elsewhere. The tubes were opaque and irregularly dilated. They were stuffed with fatty epithelium, and loose oil globules. In the cones, some of the tubes were bare and apparently empty, while others were packed with natural epithelial cells.

The malpighian bodies were natural. Iodine gave no 'amyloid' discolouration anywhere.

Comments.

This case is a characteristic example of what has been described as tubal nephritis. The patient was young. The disease was probably due to the direct irritation of alcohol. It came on suddenly and ran its course rapidly—in a little under four months. The urine was scanty throughout, the amount of albumen great, and the dropsy excessive. There was pain in the loins. The case was selected to illustrate the history of the disease rather than the treatment; but the effect of puncture upon the legs is worthy of remark. The extreme danger of making too large or numerous openings is displayed in the results which followed the use of the lancet, while the needle on the other leg did no harm. The mischief which resulted from the operation evidently contributed in no small degree to cause the death of the patient.



Urinary deposit from case of Nash. Large and small hyaline, and epithelial casts; scattered renal epithelium, some fatty.

General Dropsy, probably consequent upon cold. Urine scanty, albuminous, containing blood, pus cells, and casts. Epileptic attack. Treatment by stimulating diuretics. Acute pleurisy. Disappearance of the œdema. Death. Post-mortem examination.

Worthy White, twenty-two years of age, became a patient at St. George's Hospital, November 19, 1858. He was a hotel porter, not intemperate, according to his own statement, but in the habit of drinking two or three pints of beer a day, besides spirits. Two months before, while suffering from what he described as a severe cold, he had almost continual cramp in the feet, which prevented his walking. When this had lasted for about a week his face became puffy, he began to have pains in the loins, his urine became dark and scanty, and was passed with frequency. The dropsy increased, extending to the legs and belly. When admitted he was pale and bloated. The œdema was excessive, the peritoneal cavity was distended with fluid, and the left side of the chest was everywhere dull on percussion, evidently from the accumulation of fluid in the pleural cavity. The breathing was laborious, 24 in the minute, and the pulse rapid (120).

The urine was scanty, and dark in colour like porter. With heat it became nearly gelatinous. Sp. gr. 1019. It contained numbers of transparent and finely granular casts, cells of renal epithelium, pus cells, and blood globules. He was purged with elaterium, and had a diuretic mixture containing acetate and nitrate of potass, with twenty-five minims of tincture of cantharides in each dose. When he had been a week under this treatment he was seized with fits of an epileptic character, which came on very rapidly one after another without any interval of consciousness; these however subsided, and left him much as he was before. The dropsy continued to increase, the urine remaining very scanty in spite of powerful diuretics. On December 16, the œdema had become so great that acupuncture of the legs was thought necessary. The operation was followed by extensive cellular inflammation and vesication over one limb, while a deep abscess formed in the foot. A quantity of matter escaped through an incision, and the inflammation subsided. The casts now were such as had been found before, some of them however imbedding cells of renal epithelium. Later in the progress of the case (Dec. 21), casts of great size were seen, such as are represented in plate 3. The albumen was somewhat less in quantity, the coagulum occupying half the fluid. He now suffered from dull pain in the loins, which was frequently relieved by dry cupping. He began to complain of sharp pain on both sides of the chest, and had to be propped up in bed to enable him to breathe. In spite of local measures, and the addition of antimony to his medicine, it became evident that he was sinking under his complication of disease. His countenance became pinched, and the dropsy diminished in the belly and extremities. Without any fresh symptom he became emaciated and feeble, the dropsy finally having completely left the abdomen and legs. There was no diarrhœa, nor any marked increase in the quantity of the urine. On January 29 he quietly expired, remaining sensible until within a very short time of his death. The treatment by cantharides and other stimulating diuretics was continued to the last.

Post-mortem examination.

At the post-mortem examination the body was quite free from œdema, nor was there any fluid in the peritoneal cavity.

The brain was pale, the subarachnoid and ventricular fluid was in large quantity. In other respects the brain was healthy.

The left pleura was distended with purulent fluid, and contained a very large quantity of recently effused lymph. The lung was in an extreme state of compression; the lower lobe quite solid from this cause. The lower part of the right pleura was occupied by a similar collection of sero-purulent fluid, while the upper part of the cavity contained solid lymph, by which the fluid was limited to the lower portion. The lower part of the lung was compressed, the upper part natural. The heart and pericardium were natural.

The peritoneal cavity contained fragile bands of recent and of older lymph, by which the organs were held together. The viscera themselves were natural, excepting the kidneys.

These organs were greatly increased in bulk, about equally so: one weighed 11 oz. The capsule was quite thin and loose, the surface perfectly smooth and intensely injected. White tissue was seen at intervals, but for the most part the surface was bright red, owing to intense injection of both large and microscopic vessels. A close network of stellate vessels was evident to the naked eye, while under a low magnifying power a great system of gorged capillaries became apparent. On section there was an appearance of fine injection intermixed with a light-coloured deposit. The cortex was much increased. The cones were dark in colour. The structure was examined under the microscope in the fresh state and in hardened sections. The cortical tubes were distended and irregularly dilated with epithelial cells mixed with a small quantity of fibrinous matter. Some were $\frac{1}{287}$ of an inch in width. In one or two places little isolated patches of amorphous matter were seen, which appeared to have resulted from bursting of the tubes. There was no increase of fibrous tissue. As to the straight tubes some were natural, others had lost their epithelial lining, were greatly dilated—one as wide as $\frac{1}{186}$ of an inch—and filled with uniform fibrinous matter, such as formed the casts which were discharged with the urine; others were packed more or less closely with epithelial cells.

The epithelial cells themselves when examined separately were not unnatural; they were free from oil.

Comments.

This case is a characteristic instance of the inflammatory affection of the renal tubes. As in other cases, pus globules were formed, in the place of epithelial cells. The apparent source of the complaint in cold, its marked commencement, the rapid increase of the dropsy, and the characters of the urine, all led to the belief that the disorder was of the inflammatory type. This view was confirmed by the occurrence of the epileptic attacks. A remarkable feature in the case was the disappearance of the œdema without any obvious reason. It is probable that the great increase of fluid in the pleuræ, consequent upon the inflammatory attack, may have diverted some of the fluid from the cellular tissue. The remarkable state of injection in which the kidneys were found after death must probably be attributed to the cantharides. The epileptiform attacks which occurred succeeded to the use of this remedy. Whether they were caused by it may be a matter of doubt, but it is worth while to bear in mind, in connection with the use of this diuretic, that such attacks have been known to follow the administration of the drug in a healthy person.* I may mention that convulsive fits were produced in a dog to which I gave tincture of cantharides for experimental purposes.

The urinary casts, which were latterly of enormous size, had evidently been produced by an exudation from the walls of the straight tubes, in which channels, after death, similar cylinders of fibrine were found.

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* Case of poisoning by cantharides. Med. Times and Gazette, Dec. 10, 1864.

CHAPTER V.

CAUSES OF TUBAL NEPHRITIS CONSIDERED IN DETAIL.

COLD AS A CAUSE OF TUBAL NEPHRITIS.

Cold.

WITH adults exposure to cold is the most frequent cause of tubal nephritis. During childhood it is comparatively seldom that the symptoms can be traced to this cause.

In a series of 16 fatal cases in adults, where I had the opportunity of examining the patients during life, and their kidneys after death, the disease was traced to cold in 8; not vaguely, but to a definite exposure of which the date could be fixed, and which in most instances had given rise to other catarrhal symptoms.

More frequent cause of nephritis with grown people than children.

Of 43 fatal cases in children, some of which were under my own notice, others contributed by my colleagues at the Children's Hospital, the disease was traced to wet or cold in but 2.

It would be easy to collect from various sources a vast number of cases where renal disease has been attributed to this cause.

Dr. Wilks, in his valuable paper on Bright's disease,* gives a short history, as ascertained by himself, of 22 cases; in which, either from post-mortem evidence or from the no less conclusive fact of recovery having taken place, the disease was ascertained to be of the kind under consideration. In 10 it was traced to a definite exposure to cold or wet.

Thus both from Dr. Wilks's histories and my own, it appears that in about half the cases of tubal nephritis which are met with in general hospitals, cold or wet, or both together, are the source of the complaint.

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* Guy's Hospital Reports, 1863.

Examples.

It will be instructive to look more particularly into the circumstances under which these often harmless agencies have become so mischievous. Here are some of the more definite instances.

A gentleman rode from Maidstone to London outside a coach in very cold weather. The same evening his wife observed that his face was flabby, and a well-marked attack of renal dropsy followed, from which he eventually recovered.*

A bricklayer, very much heated by carrying a great weight, drank some beer and lay down on the damp grass. Next day he was anasarcous, and three months later he died in Guy's Hospital, where he afforded Dr. Bright one of the earliest cases of the disease which bears his name (case 4). The kidneys were enlarged, soft, pale, and apparently fatty.

A journeyman currier, who was of temperate habits, was often exposed to cold in his occupation while in a state of profuse perspiration. One day he was employed in washing skins, his feet being very wet. At six o'clock the same evening he became dropsical; he died in a month, and the kidneys were found to be greatly enlarged, and congested to the colour of chocolate.†

A labourer drank a large quantity of cold water when heated and fatigued by labour in the harvest-field. He had an attack of jaundice with 'coagulable urine,' and eventually recovered.‡

A house-painter was exposed to weather and had no food for the whole of one very cold day. In the evening he was œdematous. He died after an illness of eight months, with the large white fatty kidney.

A lamplighter was wet through for a whole week, during one or two nights of which he sat up as watchman. He

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* Bright. Guy's Hosp. Reports, 1840.

† Bright's Med. Rep., case 14.

‡ Dr. Blackall, 4th edit. p. 122.

'took a violent cold,' and had an attack of dropsy, from which he never recovered. Five months afterwards the kidneys were found to be double their natural size, white, smooth, and fatty.*

Dr. Wilks gives four cases, in all of which the disease had precisely the same origin; the patients were shipwrights, who were working over-hours, day and night, by the river side. They came into Guy's Hospital with renal dropsy. The overwork, and the subsequent exposure to the cold winds from the river, probably during profuse perspiration, set up the same symptoms in all.†

A coachman, in the habit of drinking to excess, walked eight and a half miles in the snow; next morning he was dropsical, and in a month he was dead. The kidneys were enlarged, smooth, and greatly congested.‡

A drunken shoemaker got wet through, and sat in his wet clothes; this was immediately followed by an attack of rheumatism, and in a fortnight by renal dropsy, which ended fatally. The kidneys were greatly enlarged, white and smooth.

A man of dissolute habits, but in perfect health, being hot and greatly excited by drink, jumped into the Thames and swam about for some time. He immediately felt ill, and next day dropsy set in. He died fourteen weeks afterwards in Guy's Hospital, and his kidneys were found to be large, white, and smooth.§

A child was put to bed in a newly-finished house, and had an attack of renal dropsy afterwards. The same result followed in the case of a woman from a similar cause.

Looking generally at the circumstances under which cold has given rise to renal dropsy, it appears that in the first place there is frequently some preceding cause of exhaustion. The patient is fatigued by bodily toil, or weakened by want of food, or he is a drunkard, perhaps under the influence of liquor at the time of the exposure.

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* Where no reference is given, the case occurred at St. George's Hospital.

† Dr. Wilks' cases of Bright's disease, Guy's Hosp. Reports, 2nd series, vol. viii.

‡ Case of Benj. Patrick, p. 60.

§ Reported by Dr. Wilks.

In many cases the disease has come on under circumstances of exhaustion where the exciting cause has been so trifling as to escape notice altogether. I may instance the case of a medical student (related p. 38), who had a most serious attack of what must have been tubal nephritis, after a course of very close labour as demonstrator of anatomy, while at the same time he lived in a very abstemious manner.

Cold most mischievous during exhaustion or sleep;

In the same category must be placed those cases—not rare—where the disease has arisen from cold and damp affecting the body during sleep. Sleep appears to bring with it a lowering of the nervous force, which, like exhaustion or depression, allows the body to become an easy prey to influences which produce disease.

when protracted, and when suddenly succeeding perspiration.

Next, there are two conditions of which both are usually present, always one. The cold is protracted, and it is applied during free perspiration. Cold, acting under these circumstances upon a person who has been exhausted or depressed, is likely enough in our climate to be followed by renal anasarca. It appears, however, that this statement does not hold good, or holds good only in a modified degree in climates either much warmer or much colder than our own.

In the account of Arctic expeditions, though the most intense cold was often endured, under circumstances of great fatigue, by men previously weakened by disease and hardship, renal anasarca is not among the diseases from which they suffered.*

Dr. Kane's men, though enduring extreme cold, exposed on one occasion for seventy-two hours at a mean temperature of 41° below zero, suffered fearfully from frost-bite and scurvy, but not from any renal affection. Other travellers within the Arctic circle bear the same testimony as to the nature of the diseases which the climate produces. I have been informed by those familiar with the cold districts of North America, that there renal dropsy is rare or unknown.

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* Kane's Arctic Exploration, ch. xvi.

The companions of Franklin in his earlier expedition suffered from œdematous swellings of the limbs, but this occurred after unparalleled hardships from starvation, to which some of the party succumbed. Their chief food for some time consisted of hides, and an acrid soup made from bones. It is clear that the dropsy was not of renal origin, but depended upon the extreme state of anæmia and prostration to which they were reduced. The urine is mentioned as unnaturally copious.*

Nephritis belongs to temperate climates.

Arctic cold does not produce it.

Kidneys saved by the lungs.

Renal anasarca is not a disease of the frigid zone. The travellers in that region are exposed to far greater and more sudden transitions of temperature than are ever felt in our changeable but temperate climate. Captain Parry states that his men often underwent a sudden change of 100° or even 120°, in passing from the cabin of their vessel to the outer air, and yet none but the most trifling complaints resulted. Here we have all the circumstances from which experience would lead us to anticipate renal disease: great preceding depression, intense and protracted cold suddenly applied. From these facts we may be guided as to the way in which cold acts as a source of renal inflammation. Extreme cold, though it may stop cutaneous exhalation, probably does not allow the material to accumulate. Cold increases the action of oxygen, and gives rise to increased combustion of the solids and fluids of the body. By cold the respiratory function is exalted, and the excretion of urea is diminished. With the intense cold of the North Pole, the introduction of oxygen by the lungs is probably so great, and oxydation in the body so active, that all material susceptible of such action becomes oxydized, as much of it as can be converted into carbonic acid and water passing out with the breath. The kidneys, therefore, are not liable as in temperate climates, to be irritated by excrementitious matter, for the stress of excretion falls upon the lungs.†

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* 'Journey to the Shores of the Polar Sea.' By Captain Franklin. Vol. iv.

† The importance of the skin as an organ of excretion, and the amount of resemblance between the secretion of the skin and that of the kidneys, may be learned from the following details:—

Urea is known to be constantly present in the cutaneous secretions. It has

In tropics kidneys preserved at expense of liver and bowels.

The immunity from inflammatory affections of the kidney which warm countries possess may be explained on similar principles; other excreting organs than the kidneys are in a state of increased activity. A failure in the action of the skin would occasion a demand upon the liver and alimentary canal rather than upon the kidneys. An exposure which in England might cause nephritis, in India would be more likely to cause dysentery or hepatitis.

Nerves in relation to renal inflammation.

In temperate climates it appears that the kidneys sympathise and alternate with the skin more than do any other organs. If the action of the skin is arrested, the kidneys are stimulated or irritated by the presence in the blood of the material which the skin has failed to remove. It may be that the gland will not pass the limits of healthy activity, and no harm will follow, but under unfavourable circumstances, such perhaps as exhaustion, or loss of nervous energy, the kidneys will be stimulated beyond their power of response, and a state of tubal nephritis will result. We know enough of the action of the nervous system to throw light upon the fact that exhaustion predisposes to inflammatory action. Section of the branches of the great sympathetic proceeding to a gland, paralyses the blood vessels, and gives rise to congestion of the organ concerned. With regard to the kidney in particular, it has been shown by Bernard and other experimenters, that destruction of the nerves composing the renal plexus causes the urine to become bloody and albuminous, while the kidney itself is said to be affected by a rapidly destructive process, apparently of an inflammatory kind. With the knowledge, therefore, that congestion or inflammation may result from an absence of action on the part of the vaso-motor nerves, we may easily suppose that the same changes will be peculiarly liable to happen when from

been estimated by Funke—perhaps somewhat liberally—that 157½ grains of this substance pass off in this way in twenty-four hours, which is about a third of what passes off by the kidneys in the same time. The same observer reckons that the amount of fluid thrown off by the skin varies, according to circumstances, from 2 to 29 oz. per hour; the corresponding variations of the solid residue being 14 grains and 107 grains. In the presence of urea, and of phosphates, chlorides, and sulphates of the alkalies, the components of sweat are those of urine.

exhaustion or any other circumstance this part of the nervous system acts with insufficient energy.

The progress of the disease, when it has arisen from this cause, may be briefly considered, in so far as it differs from the general account which has been given. In grown persons, a very acute and congestive form of the disease sometimes results. Examples of this form of the disorder, though less numerous than the more chronic cases, are within the experience of all who frequent a large hospital, and occur in the recorded experience of Bright, Wilks, and other writers. The following case may serve as an instance.

Exposure to snow, followed by œdema, with black and excessively scanty urine. Purpura. Febrile symptoms. Treatment by bleeding, &c. Gradual accession of coma without convulsion. Death. Examination of body.

Tubal nephritis from cold.

Benjamin Patrick, forty-nine years of age, a coachman in a gentleman's family, had been in the habit of living an easy and luxurious life. He took meat three times a day, and drank a great deal of ale and gin. He said that he never got incapably drunk, but acknowledged that he was often 'fuddled.' One very cold day in January 1854, when the snow was deep on the ground, he walked eight miles and a half in the country. At that time he was in perfect health, and had been so for years. He never had any complaint which could be referred to the kidneys. The urine had been always natural in appearance, and passed without undue frequency. The day after the exposure his ankles began to swell, and the day after that purpuric spots came out on the legs. He came into St. George's Hospital on January 11, under the care of Dr. Page, four days after the exposure to cold. The man was of robust plethoric aspect. The only symptoms of which he complained were the slight œdema and the spots on the legs, which were hæmorrhagic in character. The pulse was hard and 'kicking,' the tongue dirty, the bowels confined. He was put upon broth diet, he was bled to 12 oz., and was purged with calomel and senna. The blood formed a large loose uniform clot, nearly filling the vessel. The pulse was softer. The urine was passed with the frequent watery evacuations.

On Jan. 13 the urine was first obtained for examination. The quantity passed in the preceding twenty-four hours was but 2 oz.; it was opaque, nearly black with blood, and of the specific gravity of 1023; it was loaded with albumen, and contained multitudes of dark coarse casts, which contained blood globules and cells of renal epithelium; it scalded in passing. The swelling in the legs was now considerable, but soft; the hæmorrhagic spots were fading. He now suffered from severe dull pain in the loins, particularly over the left kidney. He was cupped to 10 oz. on the loins, the purgative draught was repeated, and he had a pill containing blue pill, digitalis, and squills, three times a day.

Next day he was free from pain, and the dropsy was almost gone, but he complained of feeling faint, and the pulse was very feeble and slow—only 58. The urine remained the same in character, but was rather more copious.

At noon on the 16th, 3 oz. of urine were produced, all that had been made since two o'clock on the previous day; it was said that none had been passed with the action of the bowels. It was rather less brown in colour, but still contained much blood—specific gravity 1018. The casts were less numerous, they were yellowish-brown in colour, and contained, as before, blood corpuscles and epithelial cells. There was also much loose renal epithelium and some imperfectly formed pus corpuscles. The patient was very drowsy, heavy in manner, and slept much. The bowels acted profusely, with watery evacuations. The pulse remained the same. He complained of pains in the limbs resembling rheumatism.

On the 19th he seemed better, and the urine was more watery. He complained of 'weight in the bottom of the belly;' the gums were spongy, and the breath fœtid from the effects of the mercury. Two days later he was again drowsy, and odd in manner, with some confusion of ideas. He appeared to be passing into a state of semi-coma. The urine, without increasing in quantity, was paler in colour. The mercury was now discontinued.

On the 23rd he said he felt nothing to complain of, but he moaned and groaned when left to himself. His movements were feeble and tremulous. The pulse was weak and quick, the skin was hot and dry, and the tongue dry and coated. A draught was now ordered, containing acetate and carbonate of ammonia, with camphor and chloric ether. He became more heavy, and on the 24th was in a condition approaching coma; he lay as if consciousness had almost departed, but when spoken to he roused himself, as if from sleep, and discoursed rationally. He breathed heavily. The pupils were contracted and remained in the centre of the orbit. The pulse was full—84. The face was puffy, but there was no œdema elsewhere. No urine was passed into the bed; what was seen was paler and in smaller quantity. Next day he was still capable of being roused, though when left alone he gave no evidence of consciousness. Breathing was very noisy, and he groaned frequently. The pulse was more feeble—74. The evacuations were passed unconsciously. Gin was now ordered, besides the ammoniacal medicine. At night he had a fit of an epileptic character, apparently accompanied with some delirium, and made so much disturbance that he had to be removed to a ward by himself. Next morning he was in a state of complete stupor, from which it was impossible to arouse him. He breathed stertorously, and uttered at intervals a peculiar cry. On the night of the 26th he expired.

Post-mortem.

At the post-mortem examination, which was made fourteen hours after death, the kidneys were found to be much enlarged—one of them weighed 10½ oz. The surfaces were smooth and intensely congested, but through the vascularity a buff groundwork could be seen. On section the cortex appeared greatly increased: it had a purplish colour, which changed by washing to a speckled brown. Under the microscope the tubes were seen to be distended with blood and epithelial cells, with much brownish granular matter. The malpighian vessels were conspicuously injected.

The liver was hard and in a state approaching cirrhosis.

There was a small quantity of fluid in each pleura, the lungs were loaded with serous fluid, and contained some patches of extravasated blood.

The brain was wet, but not unnatural in any other respect; beneath the back of the scalp was some extravasated blood.

Course of disease.

This rapid and congestive form of nephritis has never, so far as I am aware, been traced to any cause but cold. There is no line of demarcation between these and the more prolonged forms of the disease: the latter are by far the more common. The time which the disorder arising from this cause takes to reach a fatal termination varies, according to my own observation, from a few weeks to about eight months. When it ends favourably, which under judicious treatment will be the case in the majority of instances, it will mostly do so in three or four months: often in a much shorter time.

When a consequence of cold, as when it proceeds from scarlatina, hæmaturia marks the commencement in the great majority of cases. With those which recover, hæmaturia is nearly an invariable symptom, but it is less constantly present in those which end fatally.

Fatty degeneration the rule.

The progress of the disorder is such as has been sufficiently detailed in the general sketch of the symptoms of tubal nephritis. The only point which requires especial notice is the change in the character of the epithelium which takes place in the majority of the cases. The cells have a tendency to become fatty, which is much more marked than when the disorder has sprung from scarlatina or from any other cause. In cases I have examined, this was not accompanied by any obvious fatty change in other organs. The epithelium probably becomes fatty as part of the change consequent upon the inflammatory action. That fatty degeneration should occur in an inflamed tissue is accordant with all our knowledge, though in the scarlatinal form of the disease, which has shortly to be considered, it is the rule to find the epithelium free from oil.

Tubal nephritis in one kidney from loss of the other.

A more rare cause of tubal nephritis may be mentioned as resembling external cold, insomuch as the source of the disturbance is probably the secretion due to an organ other than that which is attacked by the inflammation. When one kidney has been destroyed or incapacitated by some change confined to itself, it is not unusual for its fellow to become diseased. It sometimes happens, indeed, as will be shown hereafter, that when the primary mischief has been tubercular excavation, the remaining gland becomes, in common with other organs, affected by waxy infiltration as the result of the purulent discharge. But cases are known to occur in which, after the obliteration of one kidney the other has become the seat of tubal inflammation, with its characteristic symptoms and pathological changes. The modus operandi is obvious. The remaining gland is unequal to the double work, and becomes morbidly stimulated by the duty thrown upon it.

SCARLATINA.

Scarlatina a cause of tubal nephritis.

In childhood this is by far the most frequent cause of the disorder. A case of scarlatina rarely passes through its course without some trace of albumen in the urine.

It would appear that in the course of scarlatina, as well as in certain other febrile diseases, morbid products are left in the blood which the kidneys take a share in removing.

Kidneys irritated by morbid poison.

The kidneys are irritated by the poison, which selects them as a mode of exit. This view derives support from the fact, that in other febrile diseases similar results follow, and also from the observation which must have been made by every one familiar with scarlatina, that where the throat has suffered severely, the kidneys are generally exempt. The materies morbi may exhaust itself upon the throat, or may remain in the system as a source of further mischief. It has been thought that the kidneys become affected in consequence of the inaction of the skin, which was supposed to accompany the shedding of the cuticle; but it appears that the kidneys are most endangered when the skin is affected least. It is, however, an important practical fact, that the action of external cold often acts as the immediate instigator of the renal disturbance. In many cases where no renal symptoms have been noticed, and convalescence has been apparently established, a too early exposure to weather has set up an attack of dropsy.

Frequency of association of scarlatina and albuminuria.

It is difficult to say in what proportion of cases dropsical symptoms follow scarlatina. This appears to differ at different times and in different epidemics. Dr. Hillier has found the urine to contain more or less albumen in about half the cases under his care during his experience at the Children's Hospital. From my own observation I should say that this statement is rather below than above the truth.

How large a proportion of children who suffer from renal dropsy have acquired the disease as a sequel of scarlatina, will be seen from the fact, that at the Children's Hospital, where children are treated up to the age of twelve, a series of 61 cases of albuminuria—some in- and some out-patients—gave 50 in whom the disorder was traced to scarlatina. 2 from measles, 3 from cold, and 6 from uncertain causes, made up the tale.

Sex,

The preponderance of boys over girls holds good in scarlatinal dropsy, as in tubal nephritis from other causes. Particulars have already been given bearing upon this point. I may add here, that in Dr. Tripe's table, deduced from the Registrar-General's Report, out of 1,575 fatal cases of scarlatinal dropsy, 946 were of male, 629 of female subjects. It is to be observed at the same time, that the deaths from scarlatina are nearly the same for both sexes.

and age.

Scarlatinal dropsy is exceedingly rare under a year old. As an exceptional case I may mention that a child ten weeks old was under my care at the Children's Hospital for dropsy and albuminuria, consequent upon scarlatina. It got quite well. This is the earliest age at which, so far as I am aware, the disease has been observed. Dr. Tripe has deduced from the Report of the Registrar-General, that the deaths from scarlatinal dropsy increase gradually until the fourth year of life, when they are more numerous than at any other period. They then regularly diminish in number, until after the age of twenty they become exceedingly uncommon. Scarlatina itself causes most deaths during the third year, and it is the frequency of scarlatina, rather than the disposition to renal disease, that renders scarlatinal dropsy so common among young children. It has been shown that in a given number of cases of scarlatina, dropsy is more frequent between the ages of five and fifteen than before or after these limits.

Advent of symptoms.

The renal affection may come on at any period after the first appearance of the febrile symptoms. It is often the first sign of illness which attracts notice, though in such a case a careful inquiry will probably show that the child has been exposed to the infection of scarlatina, and has perhaps been more or less feverish some days before. Dr. Tripe, who has based his conclusions upon a very large number of cases, states that though the dropsy may come on at any period of the exanthem, even the earliest, that it most often appears on the fourteenth day, but may be delayed even to the eighth or ninth week.* The experience of Dr. West leads to a similar conclusion. He assigns the second week of the disease as the most common date for the commencement of the dropsical symptoms, and believes that if delayed later, they generally take a mild form.

Of 43 cases at the Children's Hospital, where the dates were ascertained as nearly as practicable, 5 displayed symptoms of dropsy within the first week, counting from the appearance of the rash. In 27 the dropsy began at periods pretty evenly spread between the end of the first week and of the fourth. The remainder were attacked during the second month, 1 near the end of it.

Speaking generally, it may be said that after the end of the first month the danger is small, but that until the end of the second the patient cannot be looked upon as safe.

The characters of the complaint, when arising from this cause, are those which have been described as belonging to the nephritis of childhood. The course of the disease, the secondary affections, and the mode of death, are such as have been already detailed. A point of difference appears to be in the slight tendency which the renal epithelium has under these circumstances to become fatty. It is possibly owing to this that the scarlatinal form of the disease has a stronger tendency to recovery than other forms of the disorder occurring in persons of the same age. This is also a point of difference in another respect. Scarlatinal nephritis is not attended with so much congestion of the kidney as is sometimes observed under other circumstances. Even the most acute form of the disease does not occasion the purple engorgement which sometimes results from cold. The characteristic white colour is early produced, and is constant throughout the disease. The following cases are characteristic.

Condition of kidney.

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* Dr. Tripe on Scarlatinal Dropsy. Medico-Chirurgical Review for 1854 and 1855.

Scarlatinal Dropsy. Urine bloody and loaded with albumen. Pus secreted by renal tubes. Bronchitis. Gradual increase of dropsy, which became general and excessive. Patient gradually worn out by suffering. Examination of body.

Lydia Moore, a maid-of-all-work, twenty-two years of age, came into St. George's Hospital, April 23, 1856, under the care of Dr. Nairne. Five weeks previously, having up to that time had good health, she had been attacked with scarlatina in a very mild form. A week afterwards she went out on a damp day, and, as she supposed, took cold. On the following morning the legs began to swell, and she afterwards had severe and continuous pain in the loins. When admitted she was generally œdematous; the face was puffy and remarkably pallid; the pain in the loins constant. The tongue was coated. The urine was scanty (sp. gr. 1017), and loaded with albumen, smoky in colour, from the presence of blood. Abundant epithelial casts and pus globules were found. The œdema increased. Cough came on with the character of bronchitis, and there was occasional bleeding at the nose. At the end of June the œdema was still on the increase; there was evidence of fluid in the peritoneum, and dullness over the bases of both lungs, without ægophony; there was much cough and shortness of breath. The tongue was now pale, œdematous, and tremulous. The pulse small, not rapid—86. The urine had now somewhat increased in quantity, and was scarcely perceptibly smoky. The casts contained pus cells, and loose pus cells were also found. The casts are represented in plate 3.

In the early part of July the œdema was excessive; the breathing was short, though there was now little evidence of bronchial affection. The patient was very drowsy. As time went on the œdema increased, especially upon the right side, on which the patient habitually lay. In addition to the dullness over the bases of the lungs, the præcordial region now became dull, and a faint systolic murmur became audible at the apex of the heart. The urine, examined July 19, was found to contain a considerable quantity of loose pus, and to be ammoniacal. The casts were less distinct than formerly, probably acted on by the alkaline urine. Crystals of triple phosphate were found.

By the end of July (26th) the dropsy was enormous; the cellular tissue was distended all over the body. The breathing was much impeded, and vomiting, which was now frequent, was a cause of much additional distress, for the patient could not rise from a half-recumbent posture, and with every attempt to vomit she appeared to be in danger of suffocation. The pulse was now very rapid, and was hardly perceptible. The urine was paler in colour, and nearly solid when boiled. The casts, as before, contained pus globules. With the beginning of August the serous accumulation began to ooze through the skin from large visible pores, but without any sore. This exudation took place chiefly from the thighs and back, and was enough to soak four or five sheets in the course of the day. With this the œdema diminished, the urine became more and more scanty, and the patient died on the 10th, rather suddenly, as if from fainting.

Post-mortem examination.

The kidneys together weighed 17½ oz. The capsules were quite thin and loose, the surfaces perfectly smooth, white, and uniform, scarcely a streak of red to be seen. On looking closely, the lobular markings could just be distinguished by lines a trifle darker than the rest. The lobe divisions were exaggerated.

On section the cortex was anæmic, and beautifully white, like ivory; it was increased in bulk both between the cones and outside them; the cones were increased too, but in a smaller proportion.

Under the microscope, the convoluted tubes were found to be choked to opacity with epithelial cells and granular matter. The straight ducts were mostly empty, or contained only a few scattered cells; their epithelial lining having disappeared, so that only the thin membrane was left. The tubes were everywhere in contact with each other, there was no intertubular deposit, nor any increase of fibrous tissue.

The pleuræ, the pericardium, and the peritoneum were all distended with serous fluid. The lungs were somewhat congested. The wall of the left ventricle was thickened, the valves healthy. All the other viscera were examined and found natural.

The treatment has not been dwelt upon in this case, as the object in view is to illustrate the course of the disease. The measures used were hydragogue purgatives, and medicines given in order to relieve bronchial affection.

Comments.

The nature of the complaint was clear, the fact of its having arisen from scarlatina being sufficient, of itself, to declare the existence of tubal nephritis. The attack was of a very severe sort. The intensity of the renal inflammation was evinced by the abundant secretion of pus by the renal tubes; pus globules being imbedded in the casts. The suddenness of the attack, the quick increase of the dropsy, its extension into all the serous cavities, and the comparatively rapid course of the disease, are all characteristic of the inflammatory affection of the kidney. The sufferings of the patient were, as is often the case with this disorder, very great; the only relief she experienced was in death.

The following case is a type of a most intractable form of the disease:—

Insidious form of Nephritis, following scarlatina, with gastric disturbance, but scarcely a trace of œdema. Urine loaded with albumen and abounding with fibrinous casts, but without blood. Convulsive attack. Death. Examination of body.

Thomas Vallance, nine years old, was attacked with scarlatina, August 8, 1866. On the 13th he came into the Children's Hospital, under my care. The attack was slight; the throat was affected, but not severely, and the boy became convalescent, the urine being free from albumen. On the 25th, however, the urine was examined, as a matter of routine, and was found to be loaded with albumen (alb. $\frac{7}{8}$); the urine was reduced in quantity, but was not discoloured. The boy looked as well as ever; he had no symptoms which could have drawn attention to the state of the urine. There was no evidence of his having taken cold; nor had he been allowed to leave his bed.

The skin was dry, and was peeling somewhat incompletely. Next day the urine for twenty-four hours was obtained, and found to amount only to 163 C.C., or about six ounces. There was no trace of blood to be discovered. There were a few cells of renal epithelium, and a great multitude of casts, consisting for the most part of simple fibrinous cylinders, perfectly uniform and without structure. A few casts of a granular texture, imbedding epithelial cells, were also seen. The child now had a heavy manner, the pupils were large, and he had been sick; but he looked well, and had no pain nor any trace of œdema; pulse 72. He was now put upon fluid diet, allowing, however, bread and butter; ordered to drink water plentifully, and had two drachms of infusion of digitalis every four hours. Measures were taken to move the bowels, which were obstinately confined. A little brandy was given to counteract the depressing effect of the digitalis.

On the 27th the pulse had fallen to 52, and was not quite regular; the brandy was therefore increased to two ounces daily, and the digitalis given only every six hours. The urine had now fallen to less than three ounces in the twenty-four hours, still retaining the same character. There was frequent vomiting.

On the 28th the pupils were conspicuously large, and the boy's manner very slow. There was a trace of œdema before each tendo-achillis. He was not pallid, and still looked and felt pretty well. The pulse was 68. He took less food, but very often vomited, especially after the water, which was therefore not pressed. The urine now amounted only to 45 C.C., or less than two ounces. Instead of the digitalis he was ordered a diuretic draught containing scoparium, acetate of potass, and nitric ether; this, however, was always vomited, as was the brandy, the water, and almost everything else. He frequently was sick, although he had taken nothing, bringing up green slimy matter.

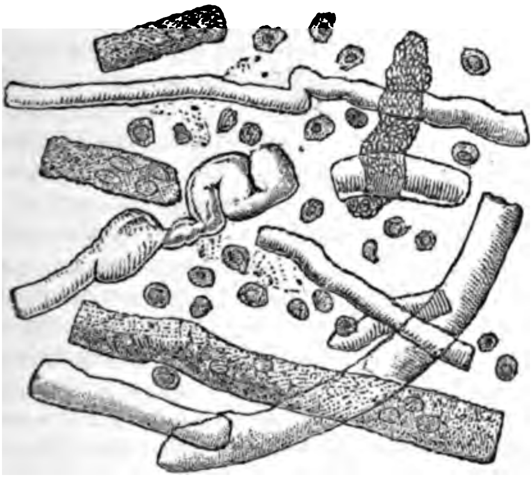
On the 29th there was no improvement; he was dry-cupped on the loins, the slowness and irregularity of the pulse appearing to prohibit the removal of blood. The diuretic mixture was changed by the addition of nitre and squills. His manner, however, became more slow and peculiar, the pupils more dilated; no increase took place in the urine, and on the 30th, as had been anticipated, he was seized with epileptiform convulsions, a succession of which came on and caused his death in two hours and a half. They were accompanied by foaming and biting of the tongue. Excepting the trace of œdema which was noticed above the heels, there was no dropsy through the whole course of the disease. The features were always sharp, and the face free from puffiness.

The urine was not in sufficient quantity to allow of the estimation of all the components on any one day. The amount of each was ascertained, some on one day, some on another; the general results are as follows. The urea was estimated on several occasions. The date of each observation is given.

Summary of Urinary Constituents, &c., in 24 hours.

Date of Observation	Quantity in 24 hours	Normal Quantity, about a quarter the adult amount (for comparison)
August 26 to 30. .	Sp. gr. 1023 to 1024	
„ 26 „ 30. .	Quantity 163 C.C. to 45 C.C.	
„ 26 . . .	Albumen = 725	
„ 26 . . .	Uric acid = ·0	·14
„ 27 . . .	Phosphoric acid = ·016	0·79
„ 29 . . .	Sulphuric acid = ·212	0·5
„ 29 . . .	Chlorine = ·017	2·0
„ 28 . . .	Urea = ·72	8·2
„ 30 . . .	„ = 1·6	. .

Always acid, and free from blood.



Urinary Deposit from the case of Vallance. Loose renal epithelium, and casts containing clear fibrine and epithelium in various states.

Post-mortem.

The body weighed 38½ lbs. There was a trace of œdema about the ankles.

The brain and all the other organs were carefully examined; all were natural. There was no serous effusion in any of the cavities. The kidneys only require description.

The kidneys weighed 11 oz. 4 drs. The capsules were natural;

the exposed surfaces were smooth and highly vascular, from the presence of a closely-woven network of minute injected vessels, which gave a general pink tint. No vessels of any size could be seen. The cortex was greatly increased, dense and firm in texture. It appeared to consist of a fine intermixture of pink and buff materials, the colours being disposed much in lines radiating from the cones to the surface. Both cortex and cones dripped with blood. The cones were of a deep purple colour. One of the kidneys is well represented, plate 1.

Under the microscope the epithelium was found to be natural. The part outside the nucleus was generally finely granular, a condition frequently found when no renal disease has existed.

The convoluted tubes were all filled with a fine granular material, in which many epithelial nuclei could be seen. A section hardened in chromic acid showed a general obstruction of the convoluted tubes by a fine smooth-looking material, which completely plugged them up, generally lying in contact with the basement membrane, which had lost its epithelial lining. There was some dilatation of the capsules of the malpighian bodies.

Comments. The case is peculiar in many respects. From the first it was evident that it was attended with great danger. The worst cases are those in which no blood makes its way into the urine. The inflammation appeared to give rise to a copious exudation of tenacious fibrine throughout the whole tubular structure; so closing the channels that the urine, scarce able to find exit, was voided in a quantity not exceeding a tenth of its proper amount. The reduction of the urinary solids was extreme. It may be observed that the urea fell to its minimum on the day when the urine was most scanty; illustrating the general rule that the amount of the urinary elements varies with the amount of water. With the extreme scantiness of the urine the absence of dropsy is remarkable. This may possibly have been due in some measure to the removal of fluid by vomiting; though, until late in the course of the disease, it did not seem that the quantity so discharged was sufficient to make up for the decrease of urine. The alteration in the pupils and in the patient's manner, taken together with the persistent vomiting, led to an anticipation of a convulsive attack, which was verified by the result.

Although this case has been inserted to illustrate the natural history of the disease, the treatment, in anticipation of what will follow, has been described in some detail, the more particularly to give an example of the failure of a plan which has been very generally successful. This case, and another which closely resembled it, are all which ended fatally of a large number of cases which during the last seven years have been subjected to similar treatment.* The rapid and extensive effusion of fibrinous matter throughout the whole gland gave a virulency to the disorder, against which any remedies would probably have contended in vain.

The following case is given as an example of an exceedingly rare form of the disease. The scarlatinal origin was rather surmised than ascertained.

Dropsy; persistent diarrhœa; peritonitis. Death. Urine free from albumen. Kidneys well-marked examples of tubal nephritis.

A child eighteen months old, named William Phillips, came into the Children's Hospital under my care. He had œdema of the face, especially of the eyelids, of the legs, and of the scrotum. The child was much emaciated and pale; the extremities were cold, the pulse rapid—132. It was stated that two months previously he was attacked with diarrhœa, which had been present more or less ever since. The dropsy had come on a fortnight ago. There was no history of scarlatina, though there appeared to be some trace of desquamation upon the legs.

The child was frequently fed with pounded meat and milk; a little brandy was given, and opiates and astringents were prescribed to check the diarrhœa, which was still present. The motions were bright green, and contained much undigested milk. The water, when obtained, was tested, with a confident expectation of finding it albuminous, but no trace of albumen could be discovered by either heat or acid. It was obtained on several occasions and examined, with the same negative result.

The diarrhœa continued, influenced very slightly by the remedies—opium, dilute sulphuric acid, tincture of the sesquichloride of iron, and acetate of lead—which were given for the purpose of controlling it. The child became very restless and fretful, vomited occasionally, and grew weaker. The quantity of brandy was increased to 3 oz. daily. The child became paler, and had a sunken look. He lay quiet and motionless, with an appearance of great prostration. The diarrhœa was still present. The skin was now very hot: 103·4; and the pulse very rapid: 160. The œdema had considerably extended. It was conjectured that an attack of an inflammatory nature had supervened; and the lungs were examined, and found to be pervaded by the sounds of fluid in the bronchial tubes. The belly was not tender. The child sunk a week after admission.

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* See paper by the Author. Edin. Monthly Journal, September 1864.

I was not able to see the post-mortem examination, but the kidneys were kept, so that I was able to examine them afterwards.

The body was emaciated (14¾ lbs.) and œdematous. Nothing was noted unnatural in the state of the lungs, excepting patches of collapse. The peritoneum contained several ounces of serum, rendered turbid by pus and shreds of lymph. On the spleen there was a thick layer of lymph. All the organs that have not been mentioned were natural; there was no tubercle. It may be stated, as furnishing a standard of comparison for the kidneys, that the heart weighed 1¼ oz., the spleen the same.

The kidneys were round and full, as if swollen; they weighed 2¾ oz. The capsules had the amount of adhesion common at that time of life; the surfaces were very anæmic. On section the cortex was increased, as compared with the cones, and was anæmic and of firm close texture. When examined in a fresh state, most of the cortical tubes were seen to be closely packed with epithelial cells and granular matter; some had lost their epithelial lining, and were empty. The same conditions were made out with more distinctness in a chromic acid section, the greater number of the convoluted tubes being densely obstructed, while some were bare and perfectly empty. The capsules of the malpighian bodies were generally dilated, so that a considerable space existed between the knot of vessel and the envelope. The epithelial cells, individually, were perfectly natural.

This case is of a kind uncommon, but not unknown. The absence of albumen in the urine in this form of renal disease has been reported by some writers, but I never recognised any other example. A statement has even been made by M. Philippe, of Berlin, to the effect that in sixty patients affected with scarlatinal dropsy he did not find the urine albuminous in a single case.* If we presume that in each of these cases the urine was tested we can only conclude that scarlatinal dropsy in Berlin is very different from scarlatinal dropsy in London. It may, however, be regarded as a fact that scarlatinal nephritis may occur and give rise to dropsy, the urine at the same time being free from albumen. The circumstance is probably one of extreme rarity. In this case all the symptoms of renal disease were present, excepting albuminuria. The peritonitis, which was the immediate cause of death, was no doubt of renal origin. No tubercles were found in the body.

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* Quoted by Jaccoud. Nouveau Dictionnaire de Médecine et Chirurgie, vol. i. p. 547.

OTHER DISEASES AS CAUSES OF TUBAL INFLAMMATION.

There is much less to be said as to the origin of nephritis from other febrile diseases. When it follows measles, it appears to follow the same course as after scarlet fever. There are two fatal cases assigned to this cause in the series of Children's Hospital cases I have referred to, and also two in which recovery took place.

Measles.

Dr. George Johnson mentions two cases of renal dropsy from this cause, one of which recovered, and the other ended fatally with inflammation of the lung and pleura. The disease appears to be identical in all respects with the form which follows scarlatina; differing only in the rarity of its occurrence.

Albuminuria, usually of a slight and temporary nature, has been found to follow or accompany diphtheria, erysipelas, typhus, small pox, pyæmia, cholera, and pneumonia; to be produced by the vicarious elimination of bile, and as the direct result of the poisons of cantharides, turpentine, arsenic, &c. Alcohol is apt to set up the disease in a more enduring and severe form.

Among the disorders of the febrile type which have this tendency, diphtheria deserves mention next to scarlatina and measles. The sequence is more constant in diphtheria than with either of the fore-mentioned diseases, though the disturbance occurs in a much milder form.

Diphtheria generally produces albuminuria.

Diphtheria appears to have a tendency, even in its earliest stage, to produce albuminuria, as we must suppose from an inherent tendency in the products of the disease, to irritate the kidneys. The poison, to use the simile of Dr. Sanderson, acts upon them like cantharides, which the moment it enters the system manifests its presence by albuminuria, and produces its series of anatomical changes in the kidney. Dr. Sanderson found the urine albuminous in every one of 8 cases, where this secretion was examined. Dr. Hillier states that of 38 severe cases, albumen was present in all but 5. In the fatal outbreak of diphtheria at Hertingfordbury, Dr. Sanderson states that there was only one case in which the urine was found to be free from albumen.*

The urine usually becomes albuminous during the height of the disease, in most cases during the first eight or ten days. The albumen may appear on the first day, rarely it is delayed until the end of the third week. In Dr. Sanderson's cases the urine was found to be albuminous within the first eight days in all but one case; in this it was not found until the eighteenth. Dr. Hillier's facts give a similar result. In 13 cases in which the urine was made the subject of daily examination there were 7 in which it was found before the fourth day, it appeared in 10 between the fourth and the ninth, in the remaining 3 between that date and the nineteenth. The urine usually resumes its natural character with convalescence.†

The secretion, when thus affected, is scanty, deep in colour, and of increased specific gravity. I have found it as high as 1032. Casts are almost always present; they are transparent fibrinous cylinders, either uniform or containing epithelial cells or blood corpuscles. In one case under my own observation the casts were dark and granular. It is stated that diphtheritic albuminuria is not accompanied by any diminution in the amount of urea and solids excreted. This, however, is very improbable.

If the diphtheria prove fatal, the kidneys are found to be more or less congested, while there is some yellow opacity of the cortical tissue, due to the accumulation of epithelium and fibrinous matter in the tubes.

But seldom constitutional symptoms.

There are usually no constitutional symptoms which can be referred to the state of the kidney, though one case has been under my own observation in which there was slight œdema of the ankles. Here the albumen was more than usually persistent, lasting for three months. Large epithelial casts were found. I am not aware of any case of intractable renal disease which can be attributed to this cause. Sometimes large epithelial casts are found in the urine, though there is no trace of albumen, and sometimes the casts remain long after the albumen has departed.

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* Dr. Sanderson. Brit. and For. Med. Chir. Rev., vol. xxv. p. 193.

† Dr. Hillier. Brit. Med. Journal, 1864, p. 347.

The febrile diseases which remain to be mentioned in detail usually produce a condition of nephritis which is mild and transient, and is seldom productive of dropsy or any of the constitutional symptoms of renal disease.

Erysipelas.

Erysipelas is in a certain proportion of cases accompanied by temporary albuminuria, which comes on with convalescence, and lasts but a short time. Sometimes the disturbance of the kidneys is more serious. Johnson alludes to the case of a child who was severely affected in this way.*

Typhus.

The evidence that typhus fever is productive of a condition of nephritis rests more upon post-mortem observations than upon clinical examination of the urine. The disorder, usually slight and temporary, seldom attracts notice by its symptoms. Cases have been recorded, however, of acute dropsy as the result of typhus fever. Dr. Johnson gives the details of one in which the symptoms came on shortly after an attack of typhus, though it was not quite clear that the relation was that of cause and effect. Convulsions, apparently uræmic, have been noticed in connection with the same disorder.

Small Pox.

Pyæmia.

The urine is stated to become sometimes albuminous during the presence of small pox,† and the same condition is frequent in pyæmic patients. After death by pyæmia the kidneys are almost always found to be in an unnatural state. The cortices are coarse in texture, firm, more or less yellow in colour, and the microscope shows that the tubes are stuffed with detached epithelium and fibrinous matter.

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[*] P. H. Bird. Erysipelas, p. 41. Dr. J. W. Begbie. Temporary Albuminuria: Edin. Monthly, Oct. 1852.

[†] Jaccoud. *Loc. cit.*

Cholera.

It is well known that during an attack of cholera the urine becomes albuminous. I am not aware that the abiding symptoms of renal disease have ever been assigned to this cause. The urine becomes albuminous, and contains renal epithelium and transparent and epithelial casts.* In patients who die of the disease the kidneys are found to be congested, and their tubes distended with an excessive growth of epithelium. It is difficult to say whether in these cases the kidneys are irritated, as in scarlatina and diphtheria, by a morbid poison, or whether, as seems not unlikely, they suffer from the withdrawal of the watery fluid which is necessary to their function. It is probable that with insufficiency of watery fluid the elements of the urine may themselves become sources of irritation.

Jaundice.

In cases of jaundice, if the urine contain bile in any quantity, it is almost certain to contain also albumen and epithelial casts. The casts are generally very abundant, and exhibit epithelial cells, or sometimes almost consist of cells which are deeply coloured with bile. Sometimes, even where no trace of albumen can be found, casts of this description abound. In some cases casts are present of the granular variety, consisting of broken down epithelium. It is rare to find any constitutional symptom of kidney disease. In 8 cases of jaundice under my own observation, where the urine contained albumen, there was only one where any œdema was present. In that instance the disease was cirrhosis, and ended fatally, in a boy eight years of age.

Acute Rheumatism.

It sometimes happens that during acute rheumatism the urine becomes albuminous, and it may be presumed that, as in other disorders, a mild form of tubal inflammation is established. The following case is in point.

Temporary Albuminuria occurring in the course of Acute Rheumatism.

Hannah Newland, twenty-eight years of age, was admitted into St. George's Hospital on Feb. 24, 1860, with well-marked acute rheumatism complicated with pericarditis. Friction was distinct all over the heart, but the heart's sounds could be heard separately, free from murmur. There was some pain in the chest, restlessness, and much prostration; the pulse was rapid, feeble, and irregular. She was admitted on the eighth day of the disease. The urine was found to be loaded with albumen, the clot occupying more than half its bulk; it was very scanty, loaded with lithates, and of high specific gravity—1030. Many casts were found, some long and slender, others of large diameter. The smaller of these contained large oil-globules, the wider were granular and irregular, owing to the deposition of lithates upon them. There was no œdema, nor any pain in the loins. The patient gradually recovered. In the course of a week the albumen had fallen to one-eighth, and no casts could be found. The patient left the hospital without any albumen in the water, and in apparent health.

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* Johnson on Diseases of the Kidney, p. 76.

Post-mortem.

In the same month of the following year the patient died in hospital of pneumonia, which was associated with a syphilitic rupial ulcer, and was apparently pyæmic. The kidneys were found to be natural in all respects, and before her death it had been ascertained that the urine was free from albumen. The pericardium was uniformly attached to the heart, which itself was of natural size and free from valvular disease.

Comments.

The occurrence of temporary albuminuria in connection with acute rheumatism is sometimes due—when the disease is complicated with endocarditis—to the detachment of fibrine from the valves, and the consequent formation of fibrinous blocks in the kidneys. Under such circumstances the urine becomes, as in this instance, albuminous, and contains casts.* But the present case was not an example of this affection. The heart's sounds were distinctly heard, free from murmur; and the subsequent examination of the body, showing that at that time the valves were natural, lent its support to the view that they had remained intact though the pericardium had been affected. The case, therefore, was probably not one of embolism. We must suppose that either a temporary state of nephritis, such as sometimes occurs with erysipelas, diphtheria, &c., had been set up by the rheumatic poison, or else that there had been a metastasis of the rheumatism to the fibrous tissue of the kidney. The first view appears the most probable. It is consistent with experience to find temporary albuminuria occurring in the course of rheumatic fever, apparently from

* See case in which fibrinous blocks were formed in the kidneys in consequence of disease of the heart. Dr. Weber, Path. Trans., vol. xvi. p. 166.

one of these causes. I have never seen the post-mortem examination of a person under such circumstances; without such evidence, the exact nature of the affection must remain uncertain.

IRRITANTS FOREIGN TO THE SYSTEM AS CAUSES OF TUBAL NEPHRITIS.

Alcohol. Among the articles of food or medicine which have the property of setting up an inflammatory state of the renal tubes, alcohol deserves the first mention. It is known that this fluid, when taken constantly in excess, particularly in the form of ardent spirit, is liable to produce chronic changes in certain viscera; but at present we have to deal with its more immediate action as an irritant of the secreting structures.

Dr. Goodfellow relates the case of a man about twenty-three years of age, who was of temperate habits, and had good health until he became barman in a large gin-shop. Soon afterwards he was attacked with dropsy and albuminuria. These symptoms lasted until, at Dr. Goodfellow's suggestion, he left his calling for a time. In the course of a month the dropsy subsided, the albumen disappeared from the urine, and with it the casts and blood corpuscles which had formerly been present; the complexion regained its usual freshness, and he seemed in perfect health. He now resumed his occupation, and notwithstanding that he observed strict abstinence in drinking, the symptoms recurred. Treatment proved ineffectual so long as he retained his occupation. He then took to a different line of life, and recovered rapidly as before, and had no further return of his complaint.* Dr. Goodfellow argues that the disorder had been produced by the inhalation of the vapour of alcohol, the patient having been constantly engaged in drawing and serving raw spirit.

Renal dropsy, with the symptoms of tubal nephritis, is by no means uncommon as the result of hard drinking. It appears, however, that this effect is more often produced by a definite period of great excess—as a single protracted debauch, or a sudden change from sobriety to drunkenness—than by habitual intemperance. A young man was recently under my care, with evidence of tubal inflammation—dropsy, the urine containing much albumen, blood, a quantity of renal epithelium, and epithelial casts—in whom the disease followed his obtaining a situation in the docks with access to the wine casks. He appeared to have made the most of his opportunities, confessing to being drunk twice a week, and taking as a minimum a quart of wine daily. After ten months of this, without any ascertained exposure or other source of disease, he was attacked with the symptoms described.

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* Dr. Goodfellow on Diseases of the Kidney, p. 177.

Cantharides, turpentine, as well as some other resinous medicines, such as copaiva, and arsenic, also have the property of rendering the urine temporarily albuminous; in other words, of setting up nephritis of a more or less mild sort.

Cantharides.

Cantharides, whether taken internally or absorbed by the skin, frequently renders the urine for a short time highly albuminous. I am not aware that œdema or any of the constitutional symptoms of nephritis have ever been traced to this cause. The urine appears to acquire an irritating property, which acts most powerfully and injuriously upon the mucous surfaces, the pelvis, bladder, and urethra, while the kidneys themselves are affected in the same manner, but to a less extent. In such cases the urine contains renal epithelium and casts of the tubes, as in nephritis from other causes, though the disturbance is of a slight and temporary nature. There can be no doubt that the renal disorder thus produced is of the nature of tubal nephritis. For an example of the irritating action of the tincture upon diseased kidneys, I may refer to the case of Worthy White, p. 50.

Turpentine.

Turpentine appears in some cases to have an action upon the kidneys similar to that of cantharides. The urine has become albuminous and even bloody after a dose of turpentine, and the same effects have followed the taking of copaiva. As the result of either of these drugs used medicinally, albuminuria is, however, very rare, and when it occurs, transient. I am not aware that the general symptoms of nephritis have ever been associated with the alteration in the urine thus produced. Renal dropsy has, however, been attributed to the inhalation of turpentine, a process by which the organs may be acted on for a much longer time than could result from any legitimate use of the drug as medicine.*

Arsenic.

Dr. S. Weir Mitchell † has related instances of œdema following the use of arsenic given as medicine. In some of these cases the urine was found to have become albuminous, containing at the same time casts of the kidney tubes. The œdema and the albuminuria came on repeatedly upon the use of the arsenic, and subsided upon its discontinuance. It therefore appears probable that a temporary state of inflammation of the kidney tubes was produced by the irritation of the poison; but the facts we as yet possess bearing upon the subject are not sufficient to allow of any confident conclusion on the point. It appears from Dr. Mitchell's statement, that persons have become œdematous in consequence of taking arsenic, without the appearance of albumen in the urine.

Lead has been regarded as a renal irritant, but it will be shown hereafter that, though lead may cause albuminuria, it is not associated with the disease in question.

Lastly, it has been stated, but on insufficient evidence, that mercury has the power of producing albuminuria.

Disease produced by various causes, same in kind, different in degree.

Thus it appears that inflammation of the kidney tubes may be set up by a great variety of renal irritants, some arising in the body, others introduced from without. The severity and duration of the inflammatory attack depends much upon the nature of the cause. The various morbid and foreign irritants which have the power of producing the disease differ much in the disturbance they produce. Thus the matter which comes upon the kidneys as the result of a certain action of cold is more mischievous than the poison of scarlet fever, the poison of scarlet fever more mischievous than that of diphtheria. Alcohol, among introduced irritants, gives rise to the most protracted and dangerous form of the disease. Turpentine may perhaps come next. It is probable that one reason for the greater power for evil which alcohol and perhaps turpentine possesses is due to the continued or repeated manner in which these substances are apt to be presented to the system. Mere drugs like cantharides, which are purely medicinal, are necessarily of transient operation, and only give rise to a very temporary disturbance.

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* Goodfellow, Diseases of the Kidney, p. 40.

† New York Journal of Medicine, June 1865.

Whether the attack is severe and attended with dropsy and other general symptoms, or is so slight as to be evinced by nothing else than a temporarily albuminous state of the urine, the disease is essentially of the same nature. The only difference is one of degree. Even in the mildest cases the urine contains the characteristic casts and epithelial deposit, and when there occurs an opportunity for examination of the kidney the tubes are found to be obstructed with epithelial growth.

CHAPTER VI.

TREATMENT OF TUBAL NEPHRITIS.

Amenable to treatment.

THERE are few disorders which are more under the influence of medicine than is the catarrhal inflammation of the kidneys. Under some plans of treatment, plans which were almost universally adopted, and still have their advocates, the disorder is one of heavy mortality. Under other circumstances the danger is so small that if once the complaint be recognised a recovery may be reckoned upon in a large proportion of cases. Without treatment of any kind there is reason to suppose that a majority of the subjects of it would recover.

After the sketch which is given in the note * of the methods

Method pursued by Bright.

* Dr. Bright,[1] writing in the year 1827, and again in 1836, advises blood-letting at the commencement of the disease—'general bleeding, freely practised and quickly repeated.' But in the cases which he reports this measure appears to have been used in a discriminating and cautious manner. The same physician advises the use of purgatives; particularly bitartrate of potass, by itself or with jalap; diaphoretics, not excluding antimony, and diuretics, particularly squills and digitalis. He appeals to his own experience as testifying to the injurious effects of mercury.

Christison.

Dr. Christison[2] urges blood-letting in the early stage of the disease as an indispensable measure. In the published cases blood-letting was practised to an extent which in these days appears incredible, and the results are such as to furnish the strongest argument against the precepts of the author.

He recommends counter-irritation to loins in the form of blisters, issues, and setons, and 'the general antiphlogistic regimen—which should in no case be relaxed until the force of the circulation has been broken.' It appears strange that Christison, writing twelve years after Bright, should have varied from his practice in a direction which appears contrary to the progress of medical opinion. Since this date venesection has gradually fallen into disrepute, of treatment resorted to by physicians whose opinions must carry weight, it remains for the author to indicate the line of practice which he holds to be advisable.

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[1] Bright's Med. Reports, vol. 1. p. 70. Bright's Guy's Hosp. Reports, 1836, p. 373.

[2] Granular Degeneration of Kidneys, 1839, p. 182.

General principles of treatment.

First, as to bleeding. The rapid tendency of the disorder to anæmia, and the apparent association of some of the worst symptoms, the convulsions for instance, with this condition, must be regarded as a caution against the abstraction of blood. In its power of impoverishing the blood, the disease is, so to speak, its own phlebotomist; beside which the readiness with which, in most cases, the kidney relieves itself by hemorrhage, makes artificial depletion unnecessary even where it might otherwise be thought desirable. Nevertheless it must be allowed that when the disorder is acute and the patient plethoric—particularly in such cases as come on from cold—the urine being extremely scanty, it sometimes appears that a moderate cupping from the loins does good. Dry cupping may be often used as a safer course.

Much mischief has probably been done by the early resort

more especially in this disease, in consequence of anæmic tendencies of the complaint.

Prout.

Dr. Prout, in his recommendations as to treatment, does not differ materially from the practice of Bright.

Todd.

Dr. Todd, in the treatment of acute renal dropsy, restricts general bleeding to cases where its purpose is to relieve congestion of the lungs. He depends chiefly on purgatives, sudorifics (avoiding Dover's Powder, the opium which it contains in his view tending to diminish the secretion of urine), and diuretics, withholding squills and cantharides in acute cases, as likely to increase the renal irritation.

Johnson.

Dr. George Johnson[1] in speaking of what he terms 'acute desquamative nephritis,' dwells upon the importance of external warmth. He advises the free use of diluents, proposes to act upon the skin by means of hot air-baths and antimonials, and upon the bowels by saline purgatives, jalap or colocynth.

Bence Jones.

Dr. Bence Jones[2] advises external warmth—particularly when the disease has resulted from cold—warm baths, vapour baths, and warm clothing. Blood-letting, if performed at all, should be, as he thinks, from the arm, not far from the loins, while the medicines advised are antimony, digitaline, and in the later stages iodide of potassium. Beside such measures to affect the general disease, hot air-baths and hard purging are advised as a means of getting rid of the dropsy, and finally iron, and certain diuretics, as nitre, cream of tartar, scoparium, and cantharides.

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[1] Johnson on Diseases of the Kidney, 1852, p. 125.

[2] Med. Times, Jan. 13, 1866.

to hard purging and means of violent diaphoresis, such as vapour baths.

A general rule holds good in albuminuria, that the solid urinary constituents vary with the amount of water excreted. This suggests the importance of increasing, if possible, the aqueous part of the urine, relying on a simultaneous increase of the other constituents; and if we have regard to the mechanism of the disease the same practical maxim must follow. The urine is impeded in its exit by the obstruction in the tubes. The more completely and generally these are stopped up, the greater the reduction in the quantity of urine. It is the character of the disorder, that from causes which have been sufficiently explained, an extravagant epithelial growth takes place in the tubes, which are narrow, tortuous, and easily blocked up. To prevent dangerous obstruction it is essential that a sufficiency of fluid should wash out the disturbed and accumulating cells. Hydragogue purgatives and vapour-baths, while tending comparatively little to remove the elements especially belonging to the urine, divert the water which is wanted for this purpose.

The whole mischief results from the blocking of the tubes. It is this which prevents the escape of the urinary products, and compels them in their own form, or in a more primitive shape, to accumulate in the blood. If the tubes can get rid of their contents the congestion of the gland will be relieved by free secretion, the system will be cleared of its impurities, the organ will gradually be restored to its healthy state, and recovery will result.

There can be no doubt that it lies in the scope of the medical art to assist or to hinder this salutary process. What we can do to assist may be shortly stated.

The object to be attained is simply to cause the passage of fluid through the kidney, while at the same time we avoid the use of such drugs as would add to the existing irritation.

Water and digitalis.

Of all diuretics water is the most valuable. The patient may be restricted to a fluid but nutritious diet, while pure water is taken freely. In children, when the kidney responds readily to this simple stimulant, the disease will generally recover without further treatment. In grown persons, or in children when the disease is severe, digitalis is a most valuable adjunct. Of all drugs this one is of the greatest value in the treatment of nephritis, and was indeed first used in medicine as a diuretic in renal dropsy. If the dropsy be excessive, and the urine correspondingly scanty, it is well to await a certain amount of diuresis by its means, increasing the fluid which the patient takes in a gradual manner, as the kidney becomes able to deal with it. I believe the best preparation of digitalis is the infusion; the doses may vary from one to four drachms, according to the age of the patient, repeated twice or thrice in the day, or in a severe case as often as every three or four hours, until the urine has become increased in quantity. The purest water should be used; patients do not object to distilled water. Two, three, or four pints a day may be taken according to the age and other circumstances.

Fomentations of digitalis leaves upon the loins have been highly recommended, and may be tried where other plans fail, though in my hands they have not met with much success. The subcutaneous injection of digitaline, as yet, so far as I am aware, untried, is a more promising expedient.

Iron, acetate of potash, &c.

Under such treatment, in the great majority of cases the urine will increase, the dropsy diminish, and the patients pass into convalescence without the occurrence of the various secondary evils which tend to swell the mortality of the disease. After the acute stage has passed, it is advisable to give iron, the perchloride for example, at the same time diminishing the quantity of digitalis. Subsequently acetate of potass, which may be advantageously combined with acetate of iron, or bitartrate of potass with steel wine, may be used to keep up the diuretic action. When the dropsy has passed away, the diuretics may be discontinued altogether, and ferruginous medicine given, either alone or with quinine. The citrate of iron and quinine answers well. If the urine still remain bloody, perchloride or sulphate of iron appears most effectual in restoring its natural character. Gallic acid, which has been often recommended under such circumstances, is in my experience perfectly useless. When the urine has become

Gallic acid useless.

copious the extra fluids may be discontinued, and if the tongue be clean and the appetite good, as will be the case if no complications are present, more substantial diet may be allowed. If the ailment should continue, and the urine be obstinately scanty, that is if the disorder tend to assume a chronic form, more stimulating diuretics may be resorted to; scoparium, nitre, juniper, and squills. Probably some cases occur, which under any treatment will end fatally. The case of Vallance is an example of a very intractable form of the disease.

Injurious results of hard purging and sweating.

Formerly it used to be common to treat renal disease in a somewhat indiscriminate manner by purging and sweating, perhaps compound jalap powder every other morning, a vapour bath every other night. This exhausting plan was based upon the notion that the disturbed kidney, like a broken bone, stands in need of repose, a condition which was sought to be attained by exciting a vicarious activity on the part of the bowels and the skin. But it is evident, from the want of success which attends this practice, that whatever good may be done, by way of relieving the gland of its work, is more than counterbalanced by the evil which results from the misappropriation of the aqueous fluid which is needed to keep the tubes clear. It may perhaps be fairly said that the repeated use of hydragogue purgatives should be limited to obstinate and hopeless cases. If life is threatened by dropsical effusions into the pleuræ or elsewhere, temporary relief may be given by a brisk dose of elaterium, or compound jalap powder; but this course should not be adopted until the failure of other measures has stamped the kidneys as irrecoverable.

Antimony.

Antimony has been recommended by several competent observers in the early stages of this disorder. I cannot adduce my own experience in its favour; I am sure indeed that most cases will recover without it. There can be no objection to its use in a severe and recent case, particularly if other medicines have been used in vain.

It is the experience of the author, that under such management as has been advised the symptoms of the disease seldom become pressing, and intercurrent disorders are comparatively rare. Should especial circumstances call for additional measures, these should not be allowed to supersede the general plan of treatment.

Acupuncture.

As to the dropsy, if so excessive as to call for mechanical relief, acupuncture may be performed. But this serious operation—for in renal dropsy it is no less—will seldom be needed. It should be done in such a manner as to secure the greatest drainage from the fewest possible punctures; made with a needle, not with a lancet.

Erysipelatous inflammation seldom fails to follow the operation when the punctures are close and numerous. It is undoubtedly true, as remarked by Dr. Goodfellow, that vesications and sores which form of themselves upon dropsical limbs are less often followed by inflammation than openings made artificially. I may draw attention to the case of Nash (p. 47), where one leg which had been pricked with a lancet inflamed and suppurated, while the other, upon which a needle had been used, did well.

The accumulation of fluid in the serous cavities will seldom require or admit of paracentesis.

Treatment of head symptoms.

For the treatment of the convulsive or other uræmic attacks, it is necessary to have regard to the anæmic state of brain by which they are accompanied, and to the fact that they are apt to come on after protracted vomiting or exhaustion from some other cause. Blood-letting of any kind is out of the question. It is doubtful whether any benefit is derived from blisters. The attacks, when of the convulsive character, frequently pass off of themselves, leaving the patient much as before. The treatment must be directed towards two ends—the relief of the cerebral disturbance, and the removal of the accumulated poison which is the source of the irritation. The urgency of the symptoms is relieved by the use of alcoholic stimulants, small opiates, and even the inhalation of chloroform. Stimulants and small doses of laudanum or Dover's powder probably do good in restoring the cerebral circulation. Extreme caution is necessary in the use of opiates in this disease. The doses must be very small; 5 or 6 drops of laudanum, for instance. In determining upon the use of opium, a very dilated state of pupil may be taken as an indication for its use (see case of Geo. Taylor, p. 94). Chloroform, which must be used with great care, probably acts by destroying the sensibility of the nervous centres to the irritation of the poison. This remedy undoubtedly has the power of holding in check uræmic convulsions. Such measures as have been described, however, are but palliative, and must be used with caution and judgment. But since the convulsive attacks are often attended with immediate peril to life, it may become necessary to have recourse to means which avert the present danger, though they have no permanent result. It is essential at the same time that measures should be taken for the removal of the peccant material. First in importance is the restoration, as far as may be, of the action of the kidneys. Probably, in its effect in removing urinary elements, a little urine is worth a great deal of any other evacuation. The bowels may be acted upon, even by aperients of the more active sort—jalap, elaterium, or croton oil; and means may be used to promote the action of the skin. Diuretics in any variety may be used, with the single exception of cantharides, and diaphoretic measures may be superadded; though with the exception of the vapour bath, which is seldom safe under such circumstances, they do not appear to have any marked power of lessening the uræmic condition.

Inflammatory complications.

Pneumonia, pleurisy, peritonitis, and the other inflammatory complications, must be treated in such a manner as not to interfere with the management of the primary disease. Mercurials, if ever of use in such inflammations, are worse than useless when these are the offspring of renal disease. The most disastrous consequences have been known to result from small doses. I might instance the case of a boy with scarlatinal dropsy whose death was caused by sloughing of the cheek produced by a single dose of grey powder—5 grains. There is not the same objection to the use of antimony. Probably the more the inflammatory complications of the disease are left to external applications, such as poultices, fomentations, &c., the better. Should the patient be attacked by erysipelatous inflammation, in addition to local measures it will often be necessary to give stimulants, or increase such as are already in use.

The following cases illustrate the treatment of the disease under the various circumstances which have been described.

General Dropsy with albuminous and bloody urine, consequent probably upon exposure to cold. Recovery under treatment by water.

Eliza Crossland, fifteen years of age, an errand-girl, who was much exposed to weather in her calling, became a patient at St. George's Hospital Nov. 28, 1860. Eleven weeks before, she had 'caught cold,' she said, but could not tell how. She had headache, cough, and was confined to bed. Five weeks later the water became dark, and swelling spread over the body, face, and limbs. She had pain in the loins, and the urine was passed with frequency. She had never had scarlet fever.

When admitted she had a puffy face and pasty complexion. The legs were œdematous, though less so than formerly. The pleuræ contained fluid, for there was dullness over the lower part of each,' before and behind, with want of breathing and absence of fremitus. There was a short cough with trifling expectoration; the respiration was rapid, 62 in a minute, the pulse 96.

The urine was almost the colour of porter, with a considerable flocculent deposit after standing. It was acid. Sp. gr. 1015. Albumen $=\frac{1}{3}$. Under the microscope numbers of casts were seen, composed of dark granular matter, probably broken down epithelium, tinged with blood; there were others, clear and fibrinous, imbedding epithelial cells. Beside blood globules in abundance, there were cells of renal epithelium, and a few pus cells. Dr. Bence Jones, under whose care the patient was, kindly handed her over to me for treatment. She was put upon fluid diet, which included a sufficiency of beef tea, and she had four pints of distilled water daily, which she drank without difficulty. Under this system all œdema disappeared, and improvement took place in every respect. On January 16, the quantity of albumen in the urine was so small that it required a considerable quantity of urine and a careful use of nitric acid to detect it. There were still numbers of casts, rust-coloured cylinders of granular matter, apparently consisting of broken down epithelium mixed with blood. A few loose blood corpuscles were seen under the microscope, though there was not enough blood to tinge the urine. The aspect of the girl was now that of health, the cheeks were quite rosy, all the œdema and pleural effusion had disappeared. Her diet was improved. A month later (Feb. 19) no albumen could be detected, nor could any blood cells be found. After long search one or two casts were found of the kind seen before. She was now in perfect health, robust and strong, and able to do much of the work of the ward. She left the hospital perfectly well. She came to show herself in the following April, according to instructions, and has since remained in health. She was last seen in the autumn of 1866.

In this case the age of the patient, and the evident fact that the disease arose from cold, made the diagnosis almost a matter of certainty. She recovered completely under the use of so simple a diuretic as distilled water. The case is related as one among a great number where the same result has followed similar measures.

Tubal Nephritis from cold. Urine highly albuminous. Œdema. Ascites. Treatment by water, digitalis, and iron. Relapse produced by a blister. Trace of albumen long evident after apparent recovery.

Edward Hill, seven years old, was brought to the Children's Hospital Sept. 3, 1864. A fortnight before, being then perfectly well, he was seized with cough and shortness of breath, which his parents said had come on after an exposure to cold. Four days later the face and legs began to swell, the chest symptoms subsiding at the same time.

When he came under observation the face was bloated and pallid, the legs and genital organs were swollen with œdema, the belly distended by fluid in the peritoneum. The chest was resonant, the pulse 112; the tongue nearly clean. The urine was highly albuminous (albumen $= \frac{1}{2}$).

He was put upon a fluid diet; 3 pints of water were ordered daily, and a drachm of the infusion of digitalis every six hours.

On the 11th all the œdema had gone. The swelling was only perceptible in the belly. The tongue was clean, pulse 100. The albumen was in about half the proportion before noted. The medicine was now given less often, and on the 14th, the improvement still going on, some perchloride of iron was added.

By the end of the month the albumen was reduced to a mere trace; there was still fluid in the peritoneum, though there was no trace of dropsy elsewhere. The child was pallid. The diet was now improved, meat being given every day, the water treatment was continued, but in place of the former medicine, a mixture containing ten grains of acetate of potass, and two of acetate of iron, was given three times a day. The albumen gradually diminished, and with it the ascites, until October 22, when no sign of the latter remained, and the child appeared to be in health in all respects, excepting that a trace of albumen could still be detected in the urine. The diuretics and the water were now exchanged for sulphate of iron and afterwards gallic acid, but the trace of albumen remained, the child all the time being, as it seemed, perfectly well. In December (14th) it was determined, though not without misgiving, to try the effect of counter-irritation. A blister was put upon the loins, and the sore kept open by means of blister ointment. The immediate effect of this treatment was a great increase in the quantity of albumen in the urine. After a time, under such measures as had been at first adopted, the albumen again became reduced to a barely perceptible quantity; this remained without change, the health of the child being perfect. On January 18 he was dismissed in this condition. He came back to show himself on the last day of the following February, by which time albumen had ceased to be evident to chemical tests. He was in perfect health.

The attack, one of inflammation of the tubes of the kidneys, came on apparently from cold, and in consequence presented a less promising aspect than if it had arisen from scarlatina. As in many cases of the same sort, a trace of albumen lingered long after the patient was well in every other respect. Gallic acid, as is usual in such cases, proved useless. The injurious action of cantharides in the inflammatory form of albuminuria, whether applied internally or externally, was displayed by a great increase of albumen after the application of the blister. The final removal of the last trace of the disease was due to time, not to treatment.

Scarlatinal Dropsy. Treatment by water, digitalis, and iron. Recovery without complications.

William Floyd, one year and nine months old, came under my care as an out-patient at the Children's Hospital, on December 19, 1861. Three weeks before, the rash of scarlatina had appeared; a fortnight later the belly, and then the face and legs, began to swell. The bowels were loose.

When seen he was puffy and pale, with elastic swelling of the limbs, which did not 'pit,' a very usual state of things with children. The belly was swollen and fluctuated; the urine smoky and intensely albuminous. He was ordered half a drachm of the infusion of digitalis, with two minims of tincture of sesquichloride of iron, three times a day, and to drink in the course of the day two pints of spring water beside his ordinary fluids.

When seen on the 23rd, he was no better, the urine had not increased, and on enquiry it was found that he had not drunk all the water. The digitalis and the tincture of iron were doubled in quantity; he was ordered to be strictly confined to liquid food, and the water was enforced. At the next visit, on the 26th, all œdema had gone, though the belly still contained fluid. The urine was still bloody, but was much less albuminous. The same system of treatment was persisted in. On January 19 all dropsy had disappeared; the urine contained no blood and only a trace of albumen. Under the action of sesquichloride of iron this rapidly disappeared; the child returned gradually to his ordinary way of living, and was dismissed in perfect health. Neither œdema nor any trace of albumen could be discovered after January 9.

The case illustrates the treatment of the uncomplicated disorder.

Scarlatinal Dropsy, with convulsive attacks. Recovery.

George Taylor, three years of age, had an attack of scarlet fever which was followed by swelling of the face, legs, scrotum, and belly. Diarrhœa came on and the swelling subsided. The bowels remained loose after the swelling had entirely disappeared. He was then attacked by vomiting, which was frequent through the whole of one night, and in the morning three well-marked epileptiform fits occurred in succession. Between the fits, and subsequently, he was drowsy. He was now brought to the Children's Hospital, and became my patient. He was extremely pallid, but without dropsy, except that the face was puffy. The head was hot, the tongue coated, the pulse rapid, 160. The urine was scanty, the colour of dark sherry; when boiled the clot of albumen occupied half the bulk of the fluid. He was ordered to be fed entirely on fluids, including strong beef tea, to drink two pints of spring water daily, and to take half a drachm of the infusion of digitalis, with half a minim of laudanum, three times a day. He had no more fits. The urine increased in quantity and gave a copious deposit of epithelium and epithelial casts. When he had been under treatment for three days all chance of head symptoms appeared to have passed away, and the tincture of sesquichloride of iron was given instead of the opium. On the fourth day the albumen was reduced to a hardly perceptible trace, and on no subsequent examination could any be discovered. Within a fortnight of his coming to the hospital he was in perfect health.*

* Several illustrations of the same method to treatment are given in a paper in the Edinburgh Monthly Journal for September 1864.

CHAPTER VII.

GRANULAR DEGENERATION—MORBID ANATOMY.

Granulation.

The external features of kidneys affected by this disease are so obvious that they cannot be mistaken, while the minute changes by which the outward form has been modified are no less evident to microscopic examination.

In using the terms 'granular' and 'granulation,' it must be understood that they refer to the state of surface, as to smoothness or the want of it. A granular kidney is one of which the surface, when the capsule has been removed, instead of being level and smooth, has upon it little projections, each of which forms the segment of a sphere, and which have been described as granulations.

Some kidneys there are which, when stripped of their capsule, remain smooth and polished, but which appear to contain in their substance specks of white matter (see p. 26). These have sometimes been described as granular kidneys, but are not granular in the sense in which the term is here used, and are totally distinct pathologically.

Results only from intertubular disease.

In kidneys which have acquired granular outsides there has invariably taken place a certain definite change in the fibrous tissue by which the tubes are separated. Of this the alteration of surface is at once the result and the proof. The change is closely analagous to that which produces cirrhosis of the liver. A morbid increase in the intertubular tissue of the organ begins at certain points upon the surface and extends inwards. The new growth as it is formed contracts, and in contracting not only encloses and compresses such parts of the gland as are in its path, but draws in the surface at its point of origin. This, taking place at regular intervals,

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GRANULAR DEGENERATION—MORBID ANATOMY.

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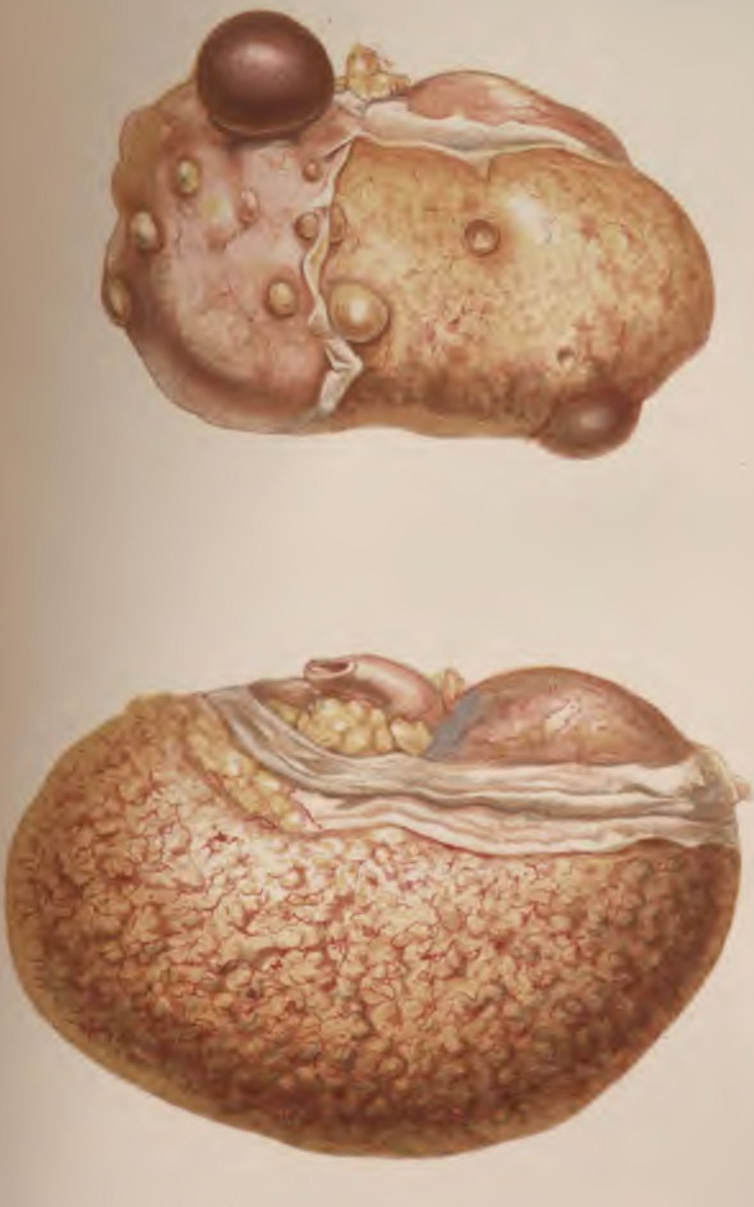
[illegible] are which, [illegible] and polished, [illegible] specks of [illegible] been described as [illegible] the sense in [illegible] distinct pathologically.

[illegible] have acquired granular[illegible] a certain definite [illegible] are separated. [illegible] result and the [illegible] that which produces [illegible] increase in the intertubular [illegible] points upon the surface [illegible]. The new growth as it is formed [illegible], and in contracting [illegible] and compresses such parts of the gland as are in its path, but draws in the surface at its points of origin. This, taking place at regular intervals,

Plate 4



PAIR OF GRANULAR KIDNEYS

[illegible]

[illegible]

results in alternate elevations and depressions, or in other words in granulation, the size of the granules being regulated by the distance between the starting points of the new formation.

The obvious changes to which this process gives rise may be shortly sketched, before proceeding to the more minute details which will rest on microscopic evidence.

EARLY STAGE OF GRANULAR DEGENERATION.

The first change which we can recognise as a result of the disease is unevenness of surface. The capsule is perhaps more adherent and thicker than natural. On removing it some part of the surface has lost its even curve and is beset with little half-formed projections of small size and almost inappreciable prominence. Often between some of these granulations veins may be detected, visible to the naked eye and having somewhat of a stellate arrangement. The colour of the organ is not at first much altered, it is perhaps of a somewhat reddish or congested tone. On section such a kidney could hardly be distinguished from one in health; it may be that the cortex has a slightly red colour, and coarse grain, and possibly one or more small cysts may be detected in it. It is not much altered in bulk. In texture it is perhaps harder than natural. Such are the more obvious characters of a kidney in an early and incomplete state of granular degeneration.

First stage of the disease.

Capsule adherent surface uneven.

If a section of such a kidney be examined with the microscope we find little fibrous processes, starting inwards from the depressions, which often imbed shrivelled tubes. Perhaps such contracted remains are all that indicate the path of the exudation. The deep parts are as yet free from any change, and the majority of tubes natural in all particulars, though here and there one may be seen packed with granular matter, or clear fibrine. The epithelial cells are natural in all respects. It has been stated that this disease depends upon a crumbling or disintegration of the epithelium; but I have never been able to find any alteration in the cells, excepting

Under the microscope.

New formation between tubes beginning at surface. Tubes at first unaffected, and epithelium natural.

now and then a deposit of oil in their outer part—a change which, as has been intimated, occurs in all varieties of renal disease, and also in health.

It may be necessary to add to these statements, that such kidneys as have been described as in this early condition of the disease have been obtained from persons who have died of some disorder not renal. There is as yet neither dropsy nor albuminuria, nor any change by which the incipient disease can be recognised.

ADVANCED STAGE.

Naked eye appearances.

Loss of bulk.

The appearance of kidneys which have reached an advanced and well-marked condition of granular degeneration is very characteristic. They are usually reduced in size, sometimes so much so that a kidney which should weigh five or six ounces may weigh only two or three. The longer the disease lasts the smaller the kidneys become. In some cases the organ has its natural weight, or is even rather increased. Sometimes the disease appears to have progressed faster in one kidney than the other, causing an inequality of size.

Change of shape.

Capsule thickened.

Surface granular.

Cysts.

The shape has lost its regularity in consequence of the shrinking having taken place unevenly; often the central portion seems to have fallen in more than the ends. The capsule is generally thickened, opaque, and adherent, though it will generally come off without tearing up the substance. The surface exposed is studded with prominent hemispherical granulations often about $\frac{1}{16}$ of an inch in diameter, though they may be either larger or smaller than this. These granules usually have a light colour like that of parched peas, while the depressed spaces between are tinted with vascularity, so that they have a purplish or faint red colour. The superficial vessels are only seen in these intermediate spaces where an irregular network often exists, forming a contrast with the prominences which are always bloodless. Cysts are often conspicuous on the surface. When a section is made through the centre of the gland the cortical part, especially near the surface, appears to have undergone most alteration. Often the part lying between the cones and the capsule is reduced to the thinness of a shilling. In colour and texture it has undergone much alteration. The natural brown colour has been replaced by a yellowish grey or buff, which often appears closely mingled with a red tint, as if two materials, a red and a yellow, were closely intermixed. The grain is closer and firmer than in the natural state. Cysts are often found both in the cones and the cortex. The cones are less affected than any other part of the organ; when altered they assume a yellowish or buff colour, approaching that of the cortex. A pair of kidneys affected as described are represented in plate 4.

Changes in cortex.

When the disease has arisen from long-continued renal congestion, as the result of heart-disease, the kidney is larger and presents a much redder colour, both within and without, than when it has come on from other causes. The granulations are smaller and more indefinite, and the distinction of colour is less marked between the granulations and the depressions. The organ is harder and more brittle, and is often loaded with blood which obscures its structure, so that it is not until the injection has been removed by soaking in water that the buff colour of the cortex is apparent.

When from heart disease.

The anatomy of the diseased organ is best made out in translucent sections, which display all the parts in their natural proportion and relation to each other. It is necessary that the preparation should include the capsular edge. The chromic acid plan answers best. A section made from a portion of the fresh tissue congealed in a freezing mixture will answer the purpose, or from a part hardened by boiling. It was by the latter method that the intertubular formation was first demonstrated. The fact that the same appearances are even better shown by other methods of preparation is an answer to a suggestion which has been made that the alterations in question were produced by the process employed.*

The microscopic appearances in advanced granular degeneration are as follows: There is an obvious increase of

Minute changes.

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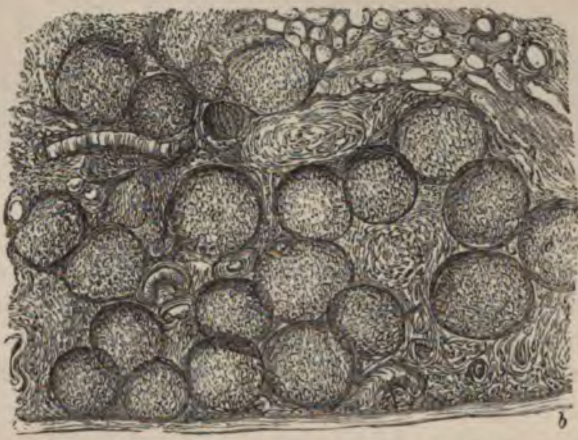
* Med. Chir. Trans. 1860. Paper on Diseases of the Kidney considered in relation to their origin in the tubes, and in intertubular structure.

Increase of fibrous tissue.

fibrous tissue in the organ. This has accumulated around the malpighian bodies and the blood vessels, so that when either are crossed by the section a thick fibrous ring is seen surrounding them.

Fibrous processes separating tubes.

The most conspicuous alterations are immediately under the capsule, which itself is thickened and adherent. At the points of superficial depression streamlets of fibrous tissue pass into the organ imbedding the malpighian bodies, which retain their size, and the tubes which become compressed, to mere microscopic threads. As the fibroid material extends inwards it becomes diffused, and spreads over and between all the tubes in its vicinity. The fibrous growth may be seen opposite each depression, as in plate 5, of visible breadth; or its existence may be chiefly indicated by the contraction it has caused, so that an angular space under the capsule is seen filled by the shrivelled remains of tubes. The malpighian bodies in such cases are aggregated, owing to the contraction of the parts between them, while they themselves resist the compressing agency. (See woodcut.)



Section of an advanced granular kidney from a gouty subject, showing the destruction of tubes consequent upon the contraction of the fibrous tissue, and the consequent aggregation of the malpighian bodies. *a b*, capsular surface, *c c*, malpighian bodies. A few tubes are seen at the deeper part of the section.

The new fibrous growth which is the essence of the disease

Plate 5.

Granular kidney

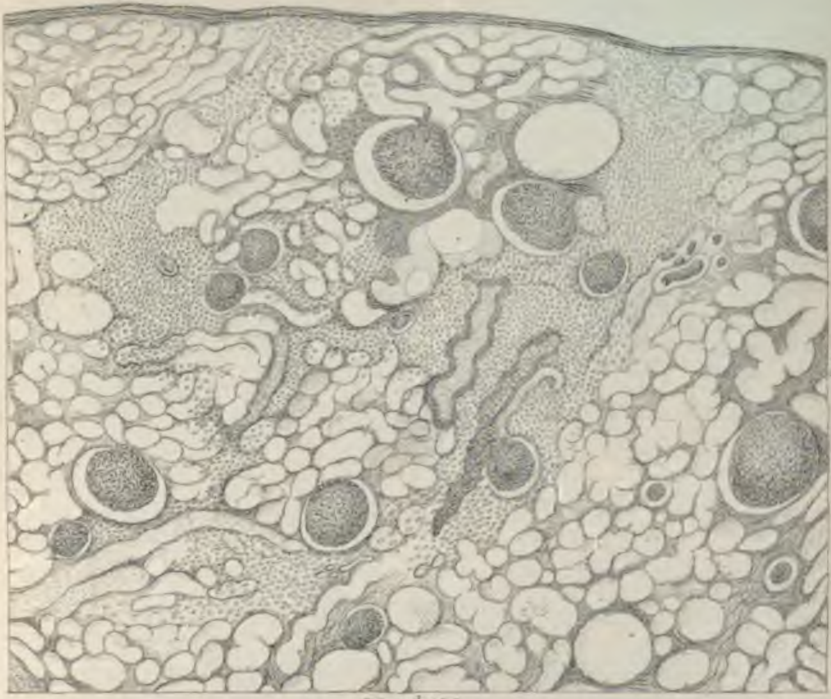


Fig 1.

Magn^{d} 40 d.

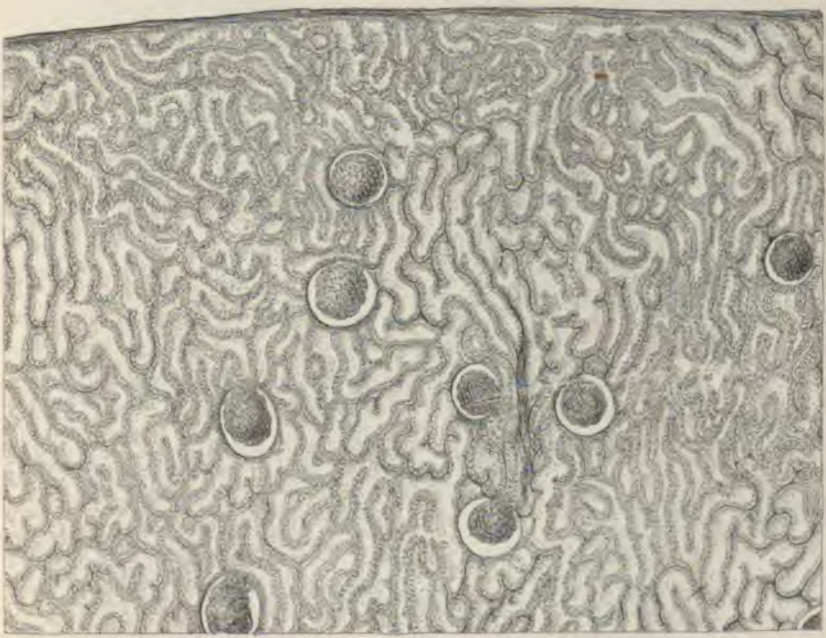


Fig 2.

Magn^{d}. 40 d.

Tuffen West, del & sc.

W West imp

Healthy kidney.

See description of Plates.

is sometimes seen in isolated patches of some extent, in the deeper parts of the cortex, but this is comparatively uncommon. Some portions of the cortical tubes have been reduced to mere threads, through which no passage remains, while in other places they are irregularly dilated. They are not uniformly affected. It is a character of the disease that the effusion which leads to increase of fibrous tissue takes place, not evenly throughout, but at points a little removed from each other. The tubes in the track of the effusion may be involved while others escape. Thus it is common, particularly in the earlier stages of the disorder, to find many tubes perfectly natural. Those that are altered are in one of two conditions, both of which are generally found in the same kidney.

Consequent changes in tubes;

some natural;

Some are irregularly packed with their epithelial growth. This condition is not uniformly spread through the organ. The accumulation of epithelium is much less decided, as well as less general, than with tubal nephritis. In many cases some of the ducts are distended with dark granular matter, probably the result of the breaking up of the epithelial cells, subsequent to their detachment from the wall of the tube. This detachment and accumulation of the cells may perhaps be explained by supposing them to have become undermined by the fibrinous exudation which is poured out by the tubular membrane.

others packed with epithelium,

Beside the tubes thus affected are others in a different condition which is a constant accompaniment of the disease. Many of the tubes are occupied by a transparent fibrinous material, which has taken the place of the epithelial lining. This material is sometimes quite uniform, transparent, and glassy; it is sometimes studded with oil globules, the result of a degenerative change in itself. Sometimes this matter, probably by being forced along the windings of the tube, becomes broken up into very fine fragments, and may eventually pass out with the urine as dark, coarse, granular casts. Such casts display at first no stricture; they look opaque and granular, but if touched with acetic acid they lose their obscurity and show the broken pieces of fibrine of which they chiefly consist.

or fibrinous matter.

What has been said with regard to the convoluted tubes will apply almost word for word to the tubes which form the cones. The contents of the latter channels exactly correspond with the casts found in the urine. They are usually filled with transparent fibrinous matter, sometimes with dark granular plugs, while sometimes they contain more or fewer entire cells of cortical epithelium.

Epithelium

While dwelling upon the morbid anatomy of granular degeneration of the kidney, it may be well to add a few words upon the condition of the epithelium. It is the more necessary to do so, as Dr. George Johnson, in his valuable work, has expressed an opinion that the change is primarily due to a crumbling or disintegration of the epithelial cells. I have examined these cells in a great number of granular kidneys, and have carefully drawn their outlines and dimensions as seen through a ⅛-inch object-glass. The conclusion I long ago formed, one which has been justified by careful and continued observation, is this. In the vast majority of cases, in all cases excepting those in which the contraction of the organ has become extreme, the epithelium is exactly such as is found in healthy kidneys. When changed, it is by an alteration in its regularity of form, becoming somewhat angular, as if cramped in growing space. In one or two cases, it was found that some cells had become shrivelled, much as the cells are found to be reduced in advanced cirrhosis of the liver. These changes, slight as they are, are never found excepting in very advanced cases. The cells may of course, from various causes, contain oil, but they do not do so more often than do the cells of kidneys, which appear to be natural, or which are affected by other morbid changes.

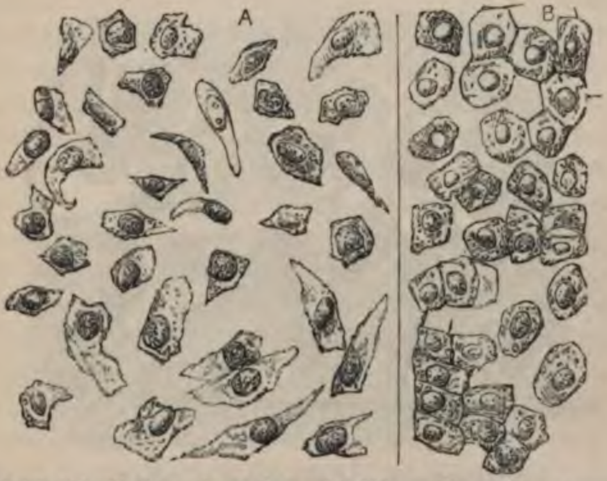
generally natural; in advanced cases distorted by pressure.

Cysts.

In the more advanced stages of the disease the granular kidney almost always contains cysts, sometimes of considerable size, sometimes microscopic. Cysts are found also in connection with the 'amyloid' disease, as will be hereafter seen, but they never occur in consequence of tubal nephritis.

Cysts are found both in the cortex and in the cones. Although frequently conspicuous objects to the naked eye, the majority of them are very minute—mostly of a diameter rather larger than that of the tubes among which they lie. They frequently have a somewhat linear arrangement, particularly evident in the cones, where they are frequently oval in shape, and lie end to end like a string of sausages. The walls are composed of thin membrane, upon which nuclei, or even epithelial cells, are sometimes seen, and which closely resemble the walls of the neighbouring tubes. From these facts there can be little doubt that the cysts are produced by the transformation of tubes. In order that this should take place, it appears to be necessary that there should be a development of a contractile tissue in the intertubular parts of the organ. By this means the tubes are narrowed where they have become involved in the exudation, and are even completely obstructed by the external pressure, as by ligature, at certain points. The occurrence of these cysts may be looked upon as a proof of the existence of intertubular formation. Within the parts so cut off, fluid accumulates until cysts are produced, which are most numerous where the atrophy of the tubes is the greatest.

From transformation of tubes.

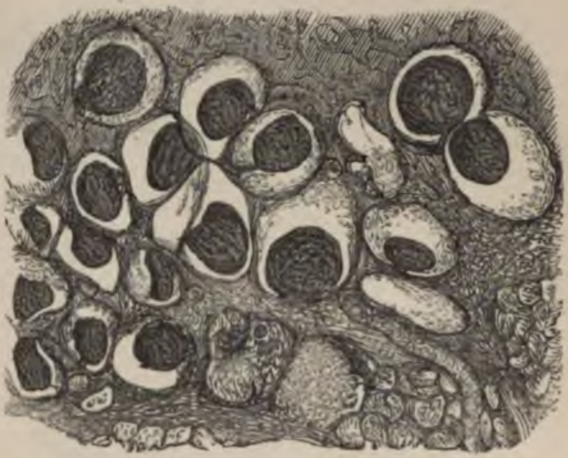


A. Epithelial cells from advanced granular kidneys, distorted by pressure.
B. Cells from natural kidneys.

By means of external pressure.

Beside the cysts thus formed there is frequently seen in this disease a peculiar dilatation of the capsules of the malpighian bodies, which become converted into cavities of a globular shape. An empty space remains between the wall and the capillary knot, which hangs like a pea in its pod, by a stalk from one side. It is generally reduced in size, and distorted in shape, as if from pressure. The cysts thus formed are often visible to the naked eye, giving a fine spongy appearance to the part of the cortex affected. They probably owe their origin to the occlusion of the tubes in the manner which has been described. The fluid poured out of the malpighian vessel is obstructed in its way out, and accumulates in and distends the capsule.

Also result from dilatation of malpighian bodies.



Section through the cortical part of an advanced granular kidney from a gouty subject, showing the transformation of the malpighian bodies into cysts. The capsules are dilated, the vascular knot compressed, while fluid has collected in the intervening space.

Thus, cysts are produced either by the subdivision of the ducts or by dilatation of the malpighian body. Both proceed from the same cause, namely, from the obstruction of the tubes by external compression.*

Before leaving the subject of cysts as depending upon intertubular formation, it may be pertinent to state, that as far as the author's observation has gone, the enormous cystic kidneys which sometimes occur appear to result simply from an extravagant extension of the process which has been described. When the kidneys have been apparently transformed into a collection of large cysts, however great the increase of size may be, the microscope generally shows that the renal structure which remains is altered in the manner characteristic of granular degeneration; and it may be added that the symptoms in such cases are such as belong to that disease.

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* See Paper by Dr. Bristowe, Path. Trans., vol. ix. p. 309. Also Dr. Hughes Bennett, Clinical Medicine, 4th edit. p. 800. Also Paper by Author, Med. Chir. Trans. 1860, p. 239.

Obstruction to circulation.

From the particulars which have been brought forward—from the replacement of the natural structure of the organ by contractile fibrous tissue—it might be presumed that the circulation through it would become greatly obstructed; and by experiment this is found to be the case. It is not necessary to repeat the details of experiments which have been already published, but it was found by passing water through the blood vessels of various natural and diseased kidneys, that with granular degeneration the kidney could not, on an average, transmit one quarter as much water as passed through a healthy kidney under the same circumstances. The experiments were made by passing water with a fixed pressure and temperature, into the renal artery, and measuring the amount which escaped by the vein in a certain time.*

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* Med. Chir. Trans. 1860, p. 243.

CHAPTER VIII.

CLINICAL HISTORY OF THE DISEASE.

It will be convenient, before proceeding to the symptoms and effects of granular degeneration, to consider its distribution between the sexes, the ages at which it is liable to occur, the conditions or morbid tendencies, if any exist, which predispose to it, and the circumstances, external to the body or arising from within, which have the direct power of producing the disease.

Sex.

Chiefly affects the male sex.

The male sex is more liable than the female to granular degeneration of the kidneys. The difference is even more decided than is the case with tubal nephritis. Taking 250 cases collected from the St. George's records, extending over a period of ten years, in each case this form of kidney being distinctly described as found at the post-mortem examination, 165 of the subjects were male, 85 female; the proportion being nearly 2 to 1. In 67 fatal cases under my own observation, in which the condition of the kidney was ascertained after death, 46 were male, 21 female, again a proportion of about 2 to 1. It will presently be shown that some of the causes of the disorder particularly affect the male sex. In a great number of cases the disease is associated with gout, or with lead poisoning. Gout seldom affects women, while, from the nature of their occupations, women are little exposed to the influence of lead. These circumstances may go a great way towards accounting for the unequal distribution of the disease between the sexes.

AGE.

Belongs to advancing years.

The disease affects a period of life which is almost exempt from tubal nephritis. Resulting, as it does, from gradual alterations of structure, and often the consequence of antecedent disease, it is seldom developed in early life. It is almost unknown before the age of 20. The author's experience has never furnished him with an example, the earliest age at which he has seen it fatal being 24. One case, however, is recorded in the hospital books, which ended at the unusually early age of 18; and this may be said to be the earliest period at which the disease has been known to cause death. Rare under the age of 30, the disorder becomes more common as 40 approaches, and about the age of 50 attains its greatest frequency. It, however, is very fatal for the whole time between 40 and 60, after which, though productive of a much smaller number of deaths, it continues to number its victims to the extreme limits of human life. The collection of cases already referred to from the St. George's books contains two instances where this form of disease was described as occurring at the age of 82, and up to this age it must be regarded as frequent, allowing for the small number of persons left alive at this advanced period. The accompanying table will show the distribution of the disease at different periods of life, distinguishing those cases which have come under my own notice, and those which are derived from the hospital records.

Most often terminating at about fifty.

Table showing the Age at which Granular Degeneration ends Fatally.

	66 Cases seen by Author	242, St. George's Books	Total 308
Age in Years	Number Fatal at stated Period	Number Fatal at stated Period	Number Fatal at stated Period
0 to 10	0	0	0
11 to 20	0	1	1
21 to 30	7	17	24
31 to 40	12	38	50
41 to 50	20	73	93
51 to 60	21	55	76
61 to 70	4	43	47
over 70	2	15	17

Causes and Antecedents.

Essentially chronic.

Granular degeneration of the kidneys, unlike tubal inflammation, is necessarily a chronic disease. It has nothing of inflammatory haste. If the gradual changes in the fibrous tissue which constitute the disorder can be described as inflammatory, the inflammation is of such a slowly progressive sort that it is never possible to fix its commencement. Resulting from insidious changes in the anatomy of the organs which give no evidence of their presence until they have attained an extent which of itself is a record of prolonged morbid action, it is evident that the causes must be of a more remote and more protracted kind than those which have been shown as liable to set up the more acute disorder.

Time of commencement uncertain, and cause often obscure.

Examining the histories of patients who have been ascertained to have died of granular degeneration, we find they generally agree in two particulars: the appearance of the symptoms has been gradual; no obvious cause can be assigned.

The origin of the complaint must be sought not in chance exposures, nor in transient circumstances of any kind, but in influences of a continuous nature.

The question will first occur whether the disorder is in any way related to the tubercular diathesis, and this must be answered in the negative.

The obscure and gradual manner in which the disorder often arises leads one to search somewhat narrowly into any constitutional vice which may act as a latent source of organic change. In the series of 250 cases of granular degeneration already referred to, collected from ten years' post-mortem experience at St. George's, I found that tubercle existed in 20·8 per cent. Again, in 67 fatal cases seen by myself, and examined after death, there were 12 in whom tubercle was found in some part of the body; generally only a trace, often a mere tubercular cicatrix in the lungs. From both these sources of information, it appears that

No relationship to tubercle.

tubercle occurs in persons thus affected with less than ordinary frequency, estimating that one fourth of those who die in London have tubercle in their bodies. It hence appears that patients who suffer from granular degeneration have had no proclivity to tubercular disease; in other words, that the chronic changes from which it arises are no part of the strumous diathesis.

Cases sometimes occur which lead to a suspicion that it may be hereditary, but I am not able to produce any evidence upon this question.

A temperate climate the only predisposing cause.

The only condition which can be with certainty stated as a predisposing cause of the disease is the climate of the temperate zone; or rather of such parts of it as approximate to the temperature of the British Isles. Further particulars bearing on this part of the subject will be found in the chapter on Climate.

The following are the conditions to which granular degeneration of the kidneys can be traced:—

Produced by venous congestion.

1. First conditions which produce and maintain venous congestion of the kidney, such as valvular disease of the heart, and pregnancy.

Gout.

2. The gouty habit, from whatever circumstance it arise, but more especially when it is associated with lead.

General fibroid degeneration.

3. A general tendency to fibroid degeneration, as shown by changes in the liver, lung, and other organs.

Some cases unexplained.

Further, it must be allowed that the disease arises in certain cases in consequence of a local tendency peculiar to the individual, or as the result of influences of which as yet we know nothing.

It very frequently comes on in a manner which, for want of more complete knowledge, we must call spontaneous. People who have been of temperate habits, who have been free from the recognised antecedents of the disease, become subjects of it we cannot tell why. Exposure to the climate of Great Britain, much as it may predispose to the disease, does not supply a reason why one Englishman should have it rather than another. In some cases it appears to be hereditary. That the renal alteration is not necessarily a part of a general degeneration is shown by the facts that the disease may arise from local disturbances of circulation, and that it sometimes occurs (in a comparatively rapid form, and in early life) without the coincidence of any other recognisable morbid changes.

VALVULAR DISEASE OF THE HEART AS A CAUSE OF GRANULAR DEGENERATION.

Effects of venous congestion.

Continued venous congestion of any organ produces as a necessary consequence certain changes in its intimate structure. Dr. Jenner, in a paper* upon 'Congestion of the Heart,' lays it down as a pathological law that mechanically induced congestion of any organ produces induration of its substance; and assigns as the immediate cause of the induration, the interstitial exudation of lymph, which may be converted into fibrous tissue. In several cases Dr. Jenner traces the process from a mechanical obstruction in the heart or lungs, to continued venous congestion of several organs, and finally to changes in their nutrition, from which they become hard and tough in texture, and increased in bulk. As to the kidneys, they are described in the cases which are adduced, as congested, hard, and often granular.

The truth of these observations cannot be doubted by any one who has had pathological experience. In the dead-house no sequence is of more constant occurrence. In a case of chronic disease of the heart, particularly of the mitral valve, the state of the kidneys may generally be predicted as in one or another stage of the same process. They will at any rate be hard, red, and full of blood, and the capsules will adhere more firmly than natural. Their bulk may be increased, the surface remaining smooth. In this case the congestion has lasted long enough to produce general increase in the fibrous tissue of the organ, but not long enough to allow of subsequent contraction. The same process continuing, the new material contracts, the surface becomes uneven and granular, and cysts are developed.

Induration of kidney followed by contraction and granulation.

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* Med. Chir. Trans., vol. lxiii.

Kidneys thus affected have a general red colour, by which, as well as by the smallness of the granulations, they may be distinguished from those which have become granular independently of a congestive origin. In their minute anatomy there is no appreciable difference between the two sorts. The granulation and contraction of the kidney, produced as described, are often very characteristic; and the symptoms which result do not appear to differ from those belonging to granular degeneration, when it has come on spontaneously or resulted from other causes. The progressive and fatal nature of heart disease necessarily brings many of the cases to a close while the renal disorder is still in an early stage.

Frequency of granular degeneration with heart disease.

The following facts will show how often valvular disease of the heart is accompanied by this change in the kidneys. In the course of 5 years, as curator of the Museum, I made post-mortem examination of 153 persons with valvular disease. 29 of these had the kidneys hard, congested, and increased in bulk, but still smooth. The kidneys in 67 had granular surfaces and more or less contracted cortices.

These facts will be seen to correspond pretty nearly with some results arrived at by Dr. Barclay, in a paper upon 'Valvular Diseases of the Heart.'* In an analysis of 79 cases of valvular disease he gives 28 as having granular kidneys.

The proportion is nearly the same in both series of observations. The kidneys are granular in more than a third of the cases of valvular disease.

No other form of renal disease has any dependence upon changes in the valves.

Double relationship.

In the analysis of cases of granular degeneration at page 138, it is seen, looking at the concurrence of the two affections in another light, that the valves are diseased in 43 per cent. of the cases of granular degeneration. This depends upon a double relationship. Valvular obstruction produces alterations in the kidney, as has been shown. Granular degeneration, as will presently appear, often gives rise to atheroma, and to endocarditis, both of which tend to produce valvular disease. But while acknowledging that in some cases the valvular disease is the secondary affection, it is clear that more frequently it is the first departure from health. It is common to find the interior of the heart healthy in cases of granular degeneration, comparatively rare to find the kidneys healthy where death has resulted from disease of the heart.

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* Med. Chir. Trans., vol. xxxi. p. 196.

Heart generally the primary change.

The following cases are examples of the development of renal disease in consequence of valvular obstruction.

Valvular Disease of the Heart, with consequent Disease of Kidneys. Dropsy. Albuminuria. Pericarditis. Death. Post-mortem examination.

Sarah Uridge, forty years of age, died in St. George's Hospital, where she had frequently been a patient. For the last four years of her life she had symptoms of heart disease, palpitation, dropsy, cough often with blood-streaked expectoration, orthopnœa, blueness and turgidity of face. The physical signs were such as led to the inference that she had mitral disease with much dilatation. There was a faint systolic murmur at the apex, there was increased præcordial dullness, and the sounds were loud. The urine was generally scanty, lithatic and albuminous. A fortnight before her death an intense friction sound was heard all over the præcordium. With this she had much tumultuous action of the heart, dyspnœa and rapidly increasing dropsy. The friction nearly ceased after four days, and blueness of the face increased, delirium came on at night, and the patient sank.

Post-mortem Examination.—It is not necessary to describe the organs in detail. The body was œdematous, and the peritoneal and pleural cavities contained much fluid. The pericardium was adherent, the cavity being occupied by a layer of recent lymph, a quarter of an inch in thickness. The heart was of large size. The auricles, particularly the right, were much dilated. All the valves were diseased. The aortic and pulmonary valves were fringed with minute beady granulations. The tricuspid valve flaps were thickened and rigid, and the orifice was narrowed so as only to admit two fingers. The mitral orifice was narrowed so that only the point of a finger could be passed into it. The anterior flap was occupied by a dense mass of calcareous matter.

The peritoneum contained a large quantity of purulent serum, but the membrane itself was not over vascular. The liver and spleen were surrounded by old adhesions. The liver was somewhat hobnailed on the surface, and its section showed much nutmeggy congestion. The kidneys weighed together 12½ oz. The surface of the left kidney was granular, and it contained a number of large cysts. One part of the surface of the right kidney was marked by deep cicatrices—the rest was smooth. The cortical tissue seemed to retain its natural proportion.

The sequence of the several organic alterations is here tolerably clear. The heart affection was of very old date and preceded all the other disturbances. The granular degeneration of the kidney arose gradually in consequence of the congestion to which it was subjected. A similar change took place in the liver from the same cause, but to a smaller extent. The symptoms of the renal disease were much masked by the state of the heart, to which, as it appeared, the dropsy was chiefly due. The urine, however, was persistently albuminous, while the albuminuria of mere congestion is transitory. The pericarditis, to which the death of the patient was chiefly to be attributed, was probably connected with the state of the kidneys rather than with the primary valvular lesion. This case is one of a sort which has importance from the frequency of the series of changes of which it is an example. As in this instance, it is usual for the symptoms during life to be conspicuously of cardiac origin. When granular degeneration occurs as a consequence of gout, a disease in itself nearly free from danger, it has time to progress and develope to the utmost extent consistent with life. But when it has sprung from cardiac obstruction, the heart is the seat of mischief which progresses at no slow rate, and which had necessarily attained a considerable power for evil before it initiated the renal disease. The heart, therefore, has the lead. But it is probable that the renal disease modifies the course of the symptoms and is the chief cause of the tendency to pericarditis which is so fatal under the circumstances.

Valvular Disease of the Heart; consequent granular degeneration of kidneys. Dropsy and epileptiform attacks. Albuminous urine. Pericarditis. Death. Post-mortem examination.

Elizabeth Brennan, admitted April 11, 1860, under Dr. Page, forty-one years of age, suffered for the later years of her life from palpitation of the heart. She had not had rheumatism. After an exposure to cold this became worse, the legs swelled, and she was taken into the hospital. A loud systolic murmur was heard at the apex of the heart. The lips were blue, the pulse was small and irregular, there was much cough, with scanty blood-streaked sputa. The urine was pale in colour and highly albuminous. On the evening of the 17th the nurse observed a peculiar wildness in her manner, which was followed by an epileptiform seizure, which left a condition of drowsiness, with slight delirium. It was then learned that she had had a similar attack some years before. On the night of the 21st, two more attacks occurred of the same character, leaving the patient in a drowsy half comatose state. The œdema increased, the action of the heart became quick and confused, and the murmur inaudible. Three days later a pericardial friction sound was heard. The patient was now in a very depressed state; she sat up in bed bending forward until she was nearly double, breathing with much difficulty. She was very drowsy, almost comatose. This condition was interrupted by an attack of screaming and delirium, after which she became comatose and died.

Post-mortem Examination.—The face was livid and the body bloated. The lower extremities were œdematous.

The pericardium contained turbid serum, and there was a copious deposit of shaggy lymph on the surface of the heart. The heart was large, the tricuspid valve rigid, and its orifice so contracted as to admit only two fingers. The mitral valve was still more contracted, so that only one finger could be forced through the opening. The edges of the flaps were very thick, and their substance hard and gristly. The left pleura contained a good deal of serous fluid, the lungs were healthy.

There was a small quantity of serum in the peritoneum.

The kidneys were very granular on the surface, their cortical tissue was much wasted, the capsules were adherent and very thick. One of them weighed 5 oz.

Symptoms could be traced to both heart and kidney. The physical signs, as well as the dyspnœa and venous congestion, were sufficient evidence of cardiac disease, while the state of the urine and the convulsive seizures pointed to the kidneys with no less certainty. The attack of pericarditis which, as in the preceding case, was the immediate cause of death, was probably chiefly of renal origin.

The cardiac mischief first took place; the kidneys became altered in consequence. The heart symptoms had existed for many years; indeed, from the condition of the valves it was evident that the disease had been of long standing. The kidneys were changed by the prolonged congestion to which they were subjected.

PREGNANCY AS A CAUSE OF RENAL DISEASE.

Another mechanical means by which venous congestion is kept up long enough in the kidneys to produce the changes in their fibrous tissue which produce granular degeneration, is pregnancy, particularly if often repeated. This, though not a common cause of the disease, has led to fatal results often enough to show the nature of the change induced.

Pregnancy a cause of renal congestion.

It has long been known that during pregnancy, probably in consequence of pressure upon the renal veins and vena cava, the urine is apt to be albuminous, that there is often œdema of the lower extremities, and that attacks of convulsion frequently come on during labour or before. The nature and treatment of these 'puerperal convulsions' have been largely studied and discussed by obstetrical physicians, but it does not appear that they were regarded as depending upon the state of the kidneys until the connection was insisted on by Sir J. Simpson.*

Puerperal convulsions, uræmic.

These symptoms are most frequent in first pregnancies, where the structures are less yielding and the pressure greater than afterwards. Obstetrical writers give different estimates of the frequency with which albuminuria occurs in pregnancy.† Dr. Litzman found it present in 37 of 131 pregnant or lately delivered females; of the 37, 26 were primiparæ. Dr. Blot detected albumen in the urine of 41 pregnant women out of 205; most of those in whom it

Albuminuria

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* Edin. Monthly Journal, October 1852.

† Quoted in Churchill's Midwifery, p. 495.

and sometimes permanent disease occasioned.

was found were cases of first pregnancy. Dr. Harley,* who does not however state the number of cases he examined, found albumen to be present in less than 4 per cent. of the cases admitted into a lying-in hospital.

Thus it appears that pregnancy often occasions enough renal congestion to render the urine albuminous, and it is known that constitutional symptoms, œdema, disturbances of vision, and convulsions, frequently result. The cause removed, the circulation will put itself right, and in the vast majority of cases the kidneys will be restored to their natural condition. If however the congestion has been such as to cause much interstitial effusion it may give rise to increased fibroid growth, subsequent contraction, and the other changes attending granular degeneration.

In the following case, the condition of kidney attained in a first pregnancy, the first stage of the disease, is shown.

Puerperal Convulsions after a first labour. Urine albuminous. Death. Post-mortem examination.

Sarah Van G., twenty-one years old, unmarried, died at Queen Charlotte's Hospital, under the care of Dr. Brodie, who kindly furnished the following particulars, and gave me an opportunity of examining the body.

She became pregnant, and was delivered in the hospital of a first child, after a perfectly natural labour. She had always had good health previously, excepting that the legs and feet had been œdematous during the later months of her pregnancy. After the child was born she passed a comfortable night, and seemed to be going on well for sixteen hours, when she had a convulsive fit which lasted ten minutes. In about an hour she had another, which was of longer duration and more severe; the face became more congested, and it was longer before consciousness returned. In a third fit, which occurred after an interval of two hours, she died.

Some urine which had been obtained was amber-coloured acid, clear and albuminous (albumen $= \frac{1}{6}$).

Post-mortem

There was a little œdema about the lower extremities. The brain was natural in all respects, the ventricles empty. The lungs

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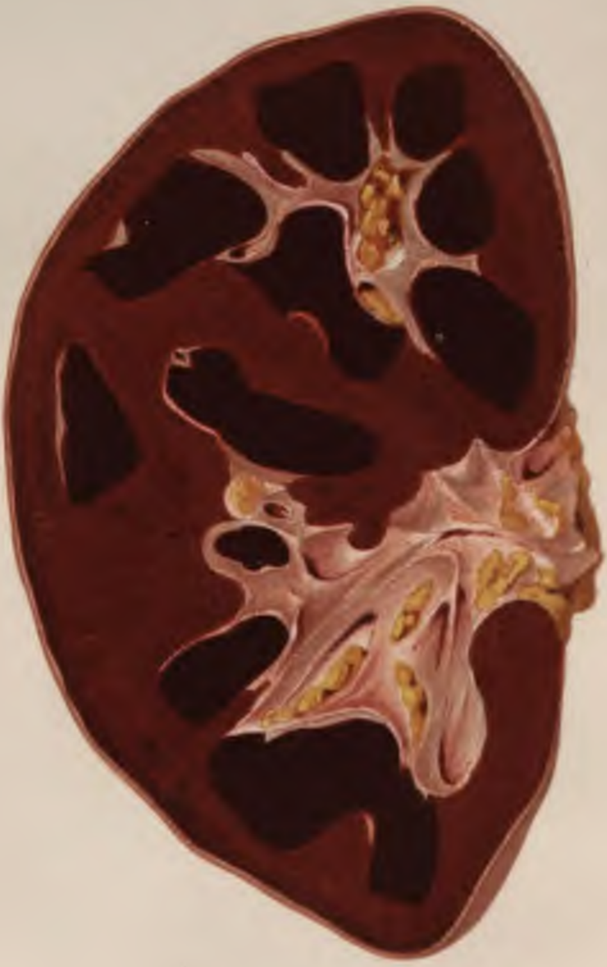
* Lectures on the Urine, Med. Times, Dec. 16, 1865.

Plate. 6



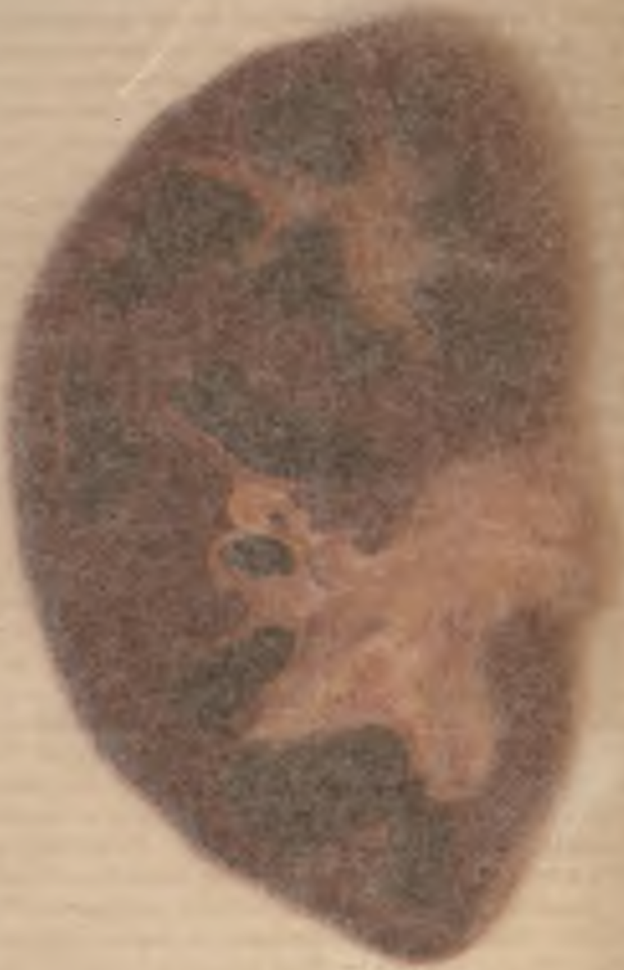
KIDNEY OF PUERPERAL CONVULSIONS. (*From case of S. Van G. Page 116.*

M & N Hanhart, Chromo lith. *See Description of Plates* were slightly congested. There were old adhesions [illegible] pericardium. The aortic and mitral valves were thickened to a trifling degree by old deposit. The liver was large and slightly fatty; there were adhesions connecting it with the diaphragm. The uterus was firmly contracted, about the size of a [illegible], and natural in all respects. [illegible]

The kidneys are accurately represented in the accompanying drawing. They were of about the normal size, but had the appearance of being swollen, looking [illegible] and full, [illegible]. The capsules were adherent and slightly thickened. The surfaces were smooth, and intensely [illegible] vessels were [illegible], but the injection was [illegible]. On section the [illegible] were seen to contain a little [illegible] were not [illegible]. The mucous membrane [illegible]. The [illegible] substance was intensely [illegible] purple colour; the [illegible] lost the faintly linear [illegible] structure like that of [illegible] colour. It was harder [illegible] increased in bulk.

A very careful [illegible] was examined in a [illegible] by freezing, and subsequently [illegible] examined. The results were of a somewhat [illegible]. The epithelium was natural. The tubes were [illegible], the channels clear and the epithelium in place. [illegible], a general opacity in the sections, the malpighian bodies [illegible] injected, the [illegible] matrix was conspicuous, and the [illegible] pervading it were very conspicuous.

This case [illegible]. Comments. There is [illegible] patient. [illegible] I had long [illegible] a case. It appears [illegible] state which is set up [illegible] is produced which is of a passive [illegible]. The congestion is not associated with any [illegible] tion, for these channels remain clear [illegible]. Such changes as there are relate to the [illegible]



[illegible]

[illegible]

examination.

ly congested. There were old adhesions in the pleuræ and n. The aortic and mitral valves were thickened to a gree by old deposit. The liver was large and slightly e were adhesions connecting it with the diaphragm. The firmly contracted, about the size of a cocoa-nut, and all respects.

dneys are accurately represented in the accompanying They were of about the natural size, but had the appeareing swollen, looking round and full, one weighing 4¾ oz. ules were adherent and slightly thickened. The surfaces oth, and intensely injected; no stellate vessels were visible, njection was minute and uniform. On section the pelves n to contain a little turbid urine, but were not dilated. ucous membrane was somewhat injected. The renal e was intensely injected throughout; the cones a deep colour; the cortex of a lighter tint. The latter had nearly faintly linear arrangement proper to it, and had a uniform re like that of close red-sandstone, but of a brighter red It was harder and denser than natural, and was relatively ed in bulk.

very careful microscopic examination was made. The organ xamined in a fresh state, sections were made of parts hardened eezing, and subsequently chromic acid preparations were exed. The results were of a somewhat negative character. The elium was natural. The tubes were unobstructed as in health, channels clear and the epithelium in place. There was, however, neral opacity in the sections, the malpighian bodies were fully cted, the fibrous matrix was conspicuous, and the nuclei perling it were very numerous.

Comments.

This case is brought forward for the sake of the morbid anatomy. here is unfortunately nothing unusual in the history of the tient. As this condition of kidney is undoubtedly one which ads in the end to granular degeneration, it is a matter of importnce to ascertain what is the nature of the change. To this purpose had long sought an opportunity of examining the kidney in such a case. It appears that the alteration is closely analogous to the state which is set up by disease of the heart. A state of congestion is produced which is of a passive rather than an active kind. The congestion is not associated with any tubal excitement, or inflammation, for these channels remain clear and undisturbed as in health. Such changes as there are relate to the blood vessels and fibrou tissue. There is a general outpouring of fluid from the distended vessels, into the interstices of the organ, which adds to its density, and may eventually become organised into new fibrous tissue, or stimulate the growth of the old. It is known that a fibrinous exudation naturally becomes converted into fibrous tissue.

The change in the kidneys, as found after death from puerperal convulsions, seems too small to account for the fatal result. But it is to be considered that it is not the kidney alone which occasions the mischief. The patient may be regarded as one suffering from a certain amount of uræmia—an amount of uræmia probably harmless so long as surrounding circumstances go smoothly—who is suddenly made preternaturally impressible by loss of blood and nervous exhaustion. The susceptibility of the nervous centres to morbid irritants thus suddenly increased, uræmic convulsions result from an apparently inadequate amount of renal disease.

The chance of progressive disease resulting is of course increased by frequent recurrence of pregnancy. The following case appears to be an example of granular degeneration gaining ground with successive repetitions of the cause.

Amelia Teal, thirty years of age, a native of Germany, came under notice while pregnant for the sixth time. Every pregnancy had been attended with swelling of the legs. She was admitted into St. George's Hospital, under the care of Dr. Bence Jones, in November 1856, with general œdema and albuminous urine. She was at that time in the second month. As the pregnancy advanced the urine became more albuminous. It was at first clear, but afterwards became smoky from the admixture of blood. Casts were found, at first transparent, latterly containing cells of renal epithelium or granular matter. They were always of medium diameter. By April, being then in the seventh month, the albumen had increased so that the coagulum occupied three-fourths of the tube. The urine was diminished in quantity, sp. gr. 1015. It was faintly acid. The œdema had now become considerable in the lower extremities, and the face was puffy and pale. There was constant pain in the loins and frequent vomiting. There was much dyspnœa, so that the patient was obliged to sit upright. Towards the end of the month labour came on, and she sank, apparently from exhaustion, two days afterwards.

Post-mortem.

At the post-mortem examination there was considerable anasarca. The state of the uterine organs was such as is generally found under such circumstances. The heart and lungs were natural, but there was a good deal of serous fluid in the pleuræ and pericardium. The liver was rather fatty. The other organs, excepting the kidneys, were natural.

The kidneys were considerably increased in size. The capsules were slightly adherent in one or two spots, but generally came off easily, leaving a surface nearly smooth to the touch, but having an appearance of incomplete large granulation. The general colour was a sort of whitey-brown, something like that of oatmeal porridge. The lobular markings on the surface had disappeared. On section the cones and cortex maintained about their natural proportion to each other, and both had much the same colour as was presented by the outside. Around the outer edge of each cone was a halo of fine radiating lines of a yellow colour. There were no cysts.

When a hardened section was examined with the microscope there was found to be a considerable formation of new fibroid tissue as a layer spread beneath the capsule. In this could be seen the remains of tubes in a contracted or compressed state, separated from each other by the new growth. The new tissue was spread more evenly than usual, not being divided into processes. The capsules of the malpighian bodies were generally thickened. The tubes near the central parts of the gland were variously dilated.

By examination in the fresh state it was found that the convoluted tubes were more or less choked up with finely divided oil. This was particularly the case where the yellow radiating lines were observed. The tubes so affected were generally about $\frac{1}{400}$ of an inch in diameter.

Globules of oil were seen upon the malpighian bodies. The straight tubes were variously packed with epithelial cells, or with amorphous granular matter. Their contents were such as had formed the casts.

The epithelium was for the most part natural, but a certain proportion of it was fatty.

Comments.

In this case the constant recurrence of œdema with each successive pregnancy, and the final appearance of decided renal disease with the last, is strong evidence that the disease was set up by the state of the uterus.

The condition of the kidneys was that of an early stage of granular degeneration. There was abundant evidence of an intertubular formation, though as yet contraction had not proceeded to the extent of distinct unevenness of surface. As appears to be often the case when this disease results from pregnancy, it was accompanied with fatty degeneration.

Kidneys after death from puerperal convulsions.

Dr. Braun describes with minuteness the state of the kidneys in women who have died of puerperal convulsions. His experience is based on the results of twelve post-mortem examinations. He describes the organs as being in one of three conditions.

Renal congestion, followed by granular degeneration.

The first condition is that of extreme congestion. The superficial vessels are dilated and full of dark blood, the cortical substance is brownish red, soft and friable; from the surface of a section there flows sticky bloody fluid with which the parenchyma is infiltrated. The cones are hyperæmic, and also the mucous membrane of the pelves. Hæmorrhagic effusions are sometimes seen.

In the second stage the congestion has given place to a general dull yellow colour. The kidneys are larger than natural. 'The surface is sometimes smooth, sometimes granulated, covered with elevations of the size of a poppy seed.' There is more or less fatty degeneration of the epithelium on the malpighian bodies.

In the third stage the kidneys are reduced to their normal dimensions, or even sink below them. The capsule is thickened and adherent, the surface of the kidney is uneven, tuberculated, and often shows deep furrow-like indentations dividing it into lobes. The cortical substance has wasted, and the organ is generally tough in texture.*

Such, according to Dr. Braun, are the conditions of the kidneys after death by puerperal convulsions; the last, more advanced, stage being less frequent than the other two.

It will be seen from Dr. Braun's account of his large experience on this subject, that the condition of the kidneys is either one of intense venous congestion, such as mechanical causes would produce, or is one of more or less developed granular degeneration. It would be easy, if it were necessary, to collect from clinical records numerous instances in which granular degeneration of the kidneys has succeeded upon the changes induced by pregnancy. The following may be adduced as examples, though the sequence will probably be regarded as placed beyond doubt by the evidence which has been already brought forward.

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* Dr. Braun, on the Anæmic Convulsions of Pregnancy, Parturition, and Childbed. Translated by Dr. Duncan, 1857.

Cases.

Professor Simpson relates a fatal case of puerperal convulsions during a third pregnancy; the attacks had come on as was supposed in consequence of mental excitement. 'The kidneys presented a well-marked specimen of granular degeneration, probably of some standing.' *

Dr. Roberts, in his valuable work on Renal Diseases, gives two cases in which the kidneys have become diseased in consequence of pregnancy. They are shortly as follows:—

A married woman, thirty-nine years of age, while in the third month of her sixth pregnancy, had frequency of micturition, œdema of the face and legs, and albuminous urine. She miscarried at the fifth month, but the urine continued albuminous. Transparent casts, and others containing epithelium, were found. The dropsy disappeared, but the patient had repeated attacks of convulsion, and more than a year after the symptoms had commenced died in a state of coma. After death the kidneys were found to be granular and atrophied.

In this case it may be presumed that the renal mischief had begun in some of the preceding pregnancies.

Another case, quoted by the same author, is that of a servant-girl who became pregnant at the age of 26. Towards the end of her time the legs became œdematous. The dropsy disappeared after the birth of the child, and for two years she remained in apparent health. General, but not excessive, œdema then came on, conjoined with fugitive disorder of vision, occasional attacks of diarrhœa, and general failure of health. When seen medically, the urine was found to be pale and albuminous, and the dropsy had extended to one pleural cavity. The sight afterwards became more impaired and the patient died comatose after a series of convulsive attacks. Death took place about three years after the first appearance of dropsy. 'The kidneys were in a state of fatty degeneration, with beginning granular atrophy.'

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* Edinburgh Monthly Journal, 1852. Oct. (Case 1.)

This case is valuable as taken in conjunction with the others. It is probable that the renal mischief was started by the pregnancy, and gave rise to the œdema which was then observed; the changes progressed afterwards in the latent manner in which granular degeneration proceeds, and terminated in the well-marked disease which caused the death of the patient.

GOUT AND LEAD POISONING.

Association of gout with granular kidneys.

The disease under consideration is a frequent result or accompaniment of gout. It is one of the results of the gouty diathesis, and may either precede or follow the external manifestations of the disease. The association of granular degeneration with gout is one of the most undoubted of pathological facts. Dr. Todd was I believe the first to draw attention to this relationship.* He published several cases in which gout was accompanied by albuminuria, which post-mortem examination showed to depend upon a granular, contracted, and cysted condition of the kidneys. Dr. Garrod has also dwelt upon this condition of the kidneys as connected with gout, and has given numerous cases.† He describes particularly a deposit of crystalline urate of soda in the tissue between the tubes, and states that he has only seen one instance in which the post-mortem examination of a gouty patient has failed to show distinct affection of these organs.

I found that among 69 cases of fatal granular degeneration there were 16 in whom the disorder was dependent upon or coincident with gout. It is scarcely necessary to insist that in such cases the gouty condition comes first; the renal mischief follows as a consequence. Disease of the kidneys does not appear to set up the constitutional disorder, for however the kidneys may have been affected by disease other than granular degeneration, gout is not known to follow.

Gout the

In the histories of cases where articular gout and albuminprimary affection.

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* Clinical Lectures by Dr Todd, Urinary Diseases. Lecture 12.

† Garrod on Gout, 1859, p. 236.

uria have co-existed, the joint affection is usually the first to appear, and frequently dates back so far, that chronic as granular degeneration sometimes is it is difficult to suppose that it could have anticipated the external symptoms. I knew a case, at last fatal from the renal disease, where gouty symptoms had existed, off and on, for twenty-six years; and such instances are by no means uncommon.

The long precedence of the external symptoms of gout is particularly noticed when the disease is connected with hereditary influence or good living.

Lead-gout.

The gouty condition, as Dr. Garrod has shown, is one of the results of the absorption of lead. He states that about 30 per cent. of gouty patients in hospital practice have been under this influence. This accounts for the frequency of granular degeneration in plumbers, painters, compositors, and others who have been conversant with that metal. If a man who has a blue line on the gums have also albuminuria it is almost certain that he has also this variety of renal disease.

Association of lead with granular degeneration.

Looking back through the hospital records for a period of seven years during which I was concerned in keeping them, I find that 42 men having to do with lead, as painters, plumbers, tin-workers, and compositors, died from disease or accident, and were examined in St. George's. This includes both surgical and medical cases. Of this number 26 had distinct granular degeneration of the kidneys, in most of which that disease having led to the death of the patient. It is clear that the action of the lead is the cause, direct or indirect, of this astonishing proportion of renal disease. Whatever be the occupation of the person exposed to the influence of lead, whether painter, compositor, plumber, or tin-worker, he appears to have the same tendency to granular degeneration. The mischief is due to the metallic poison, which all share. Granular degeneration is the only form of renal disease which lead appears to induce. Among the number stated there was but one instance of the occurrence of any other renal affection, and that was clearly due to cold and exposure.

Painters, &c. generally die of it.

Constantly as this cause operates, the number of the labouring community who are exposed to saturnine influence is comparatively small, and it will be interesting to inquire what proportion lead poisoning bears to other morbid influences as a cause of the disease. I have notes of 45 men who died of granular degeneration, of whom the occupation was known. Of these 10 had been exposed to this influence, 9 were painters; 1 a compositor, with evidence of lead poisoning.

From these particulars it is not too much to assert that of painters at least one half eventually die of granular degeneration of the kidneys; while as compared to other external circumstances the influence of lead is a more fertile source of this disease than any other with which we are acquainted.

Kidneys may be affected without other signs of gout.

It is certain that many cases of renal disease thus produced are associated with gout, and that urate of soda often exists in the kidney. At the same time granular degeneration frequently occurs apparently in consequence of the metallic poison in cases where there have been no external gouty symptoms. The gouty affection of the joints and granular degeneration are associated as springing from a common cause.

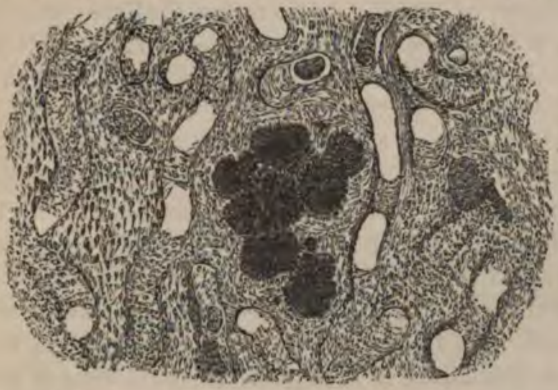
Alcohol selects the joints, lead the kidneys.

If the morbid tendency affect the joints we have the ordinary symptoms of gout; if the kidney the characteristic granular degeneration. It appears that where the gouty condition has resulted from alcoholic liquors it tends chiefly to the joints; when from lead to the kidneys. The rich man enjoys long life with gout in his extremities, the artisan perishes perhaps before his limbs are touched, from change of the same nature in the kidneys.

Gout of the kidney; structural changes.

The change must be regarded as gout of the kidney.

Gout manifests itself not only by a deposition of urate of soda in the cavities of joints, but by peculiar changes in certain of the fibro-cartilaginous and fibrous structures. Fibrous tissue is a chosen seat for the morbid action. The fibrous structures and the cellular tissue around joints become incrusted and infiltrated with urate of soda, and are at the same time thickened and indurated as by chronic inflammatory action. The ligamentum patellæ, the tendo-achillis, and the tendons of muscles, have been found to be thus altered, and sometimes are infiltrated with the crystalline deposit, or contain it in the form of small white specks in their substance. From what has been said elsewhere it will be seen that the affection of the kidney in these cases is analogous to the effects of gout elsewhere. We find, as Dr. Garrod has pointed out, and I can confirm, that there occurs a deposition of urate of soda between the tubes, connected that is with the intertubular fibrous tissue of the gland.* This portion of the organ becomes thickened by a sort of chronic inflammation; it contracts and compresses the tubes, and the granular kidney results. This description holds good whether the gouty condition has resulted from intemperance, from the absorption of lead, or from any other circumstance.



Section through one of the cones of an advanced granular kidney from a gouty subject, showing the crystalline masses of urate of soda in the intertubular fibrous tissue.

GENERAL FIBROID DEGENERATION AS A CAUSE OF RENAL DISEASE.

In old age, and with drunkards.

It is known that one of the tendencies of old age is to fibroid thickening, and increase of fibrous tissue in many parts of the body. A less general fibroid degeneration results from the excessive use of alcoholic liquors, particularly ardent spirits.* As the result of spirit-drinking, the most marked effect is upon the liver and lungs, though the kidneys are not exempt. The influence which alcohol has in causing renal disease is considered elsewhere.

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* See Dr. Garrod on Gout.

This general tendency, from whatever cause it arise, may affect the kidney in common with other organs. As a means of estimating the frequency with which granular degeneration occurs as part of a general fibroid change, I ascertained the proportion of cirrhosis of the liver, and thickening of the capsule of the spleen as associated with granular kidneys.

Granular degeneration, association with cirrhosis, &c.

In 250 cases of granular degeneration, the liver was cirrhosed in 37, a proportion of about 1 case in 7, while there was noticeable thickness or opacity of the capsule of the spleen in 47, a proportion approaching 1 in 5. These numbers may give a rough estimate of the frequency with which the exaggeration of fibrous tissue which constitutes granular degeneration has affected other organs besides the kidney.

Change confined to the kidney more often than not.

The proportion is not large. In this country the kidneys are prone to morbid actions, especially to such as affect their fibrous element. They suffer from influences which are concentrated upon themselves, while at the same time they are prone to participate in such general disturbances as promote the encroachment of fibrous tissue upon other organs. Their sympathy in this respect is most evident when the source of the change is valvular disease. When venous obstruction has resulted from uterine enlargement, the kidneys are usually affected alone. The hepatic and splenic veins are, from their position, free from the injurious pressure which the gravid uterus exerts upon the vessels which return the blood from the kidneys. Gout, too, attacks the kidneys while other viscera are exempt from its influence, though in this case the reason of the preference is unexplained.

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* See paper by Dr. Sutton on Fibroid Degeneration of the Lungs, Med. Chir. Trans., vol. xlviii.

CHAPTER IX.

SYMPTOMS OF GRANULAR DEGENERATION OF THE KIDNEY.

This disease has been described in a preceding chapter, as the result of changes at first insignificant, beginning in a certain part of the gland, and then creeping on, step by step, until decided alterations are produced in its construction. The symptoms are developed in the same insidious manner. It is impossible to recognise the disorder until it has reached what is really an advanced stage. The symptoms which then declare its existence are often of such a kind as to be easily attributed to diseases of other organs. A patient who has reached adult life may come under observation, suffering from dyspepsia and vomiting, or with general debility, or complaining only of depression of spirits, or with dimness of vision, or with bronchitis, or with slight and transient œdema, or with decided dropsy. With one or more of these symptoms, it is noticed that he has an unhealthy look—somewhat of the 'pallor luteus.' He has perhaps sharpened features, and an anæmic appearance; while a sort of sunburnt tinge upon the skin prevents the whiteness characteristic of the more acute disease, and gives a sort of whitey-brown hue to the face. The tendency to anæmia is less marked than with other forms of renal disease, and the patient, particularly if the disease be early, or be associated with affection of the heart, may even have somewhat of a florid complexion, giving a delusive aspect of health.

Insidious beginning, disturbances often of other organs.

Complexion changed.

Anæmia sometimes little marked.

Perhaps, after various measures have been unsuccessfully directed to some troublesome symptom, its renal origin is suspected, and albumen discovered in the urine. If now the patient be questioned as to his previous health, it is found that for some time, perhaps for years, it has been

Often latent.

more or less broken. The urine has been increased in quantity, and passed more often than formerly. Perhaps it may have been noticed, on one or more occasions, that it was black from the admixture of blood. If there should be any œdema, it has come on gradually, without any such obvious cause, as exposure, scarlatina, or intoxication.

Cause seldom obvious, commencement obscure, progress slow.

This disease differs from other renal disorders in the obscurity of its commencement, and in the consequent difficulty in fixing its duration. While other renal affections are generally evident on their first appearance, and run a tolerably rapid course to recovery or death, it is scarcely possible with granular degeneration to say how long it may last. Essentially a chronic disease, it would be easy to multiply instances * where it has been known to exist for ten, fifteen, or even twenty years. It happens, in the greater number of cases which end fatally in hospitals, that the symptoms can only be traced back for a comparatively short time, but this arises from the indifference of the working class to slight ailments, so that they only come under notice when the later symptoms of the disease have accumulated upon them, and they are incapacitated by dropsy or some of the consequences of uræmic poisoning.

Early changes in urine.

One of the earliest symptoms which may lead to a suspicion of the disease is an increase in the quantity of urine, which is pale and of low specific gravity. It is passed more often than natural, especially at night, apparently in consequence of its increased quantity, not because it has acquired any irritating quality. If examined in this early stage it may be found perfectly free from albumen, or may contain only a minute trace. Casts are sometimes found before the albumen is appreciable. So long as the urine retains its abundance the patient will remain without any trace of dropsy. It is probable that his earliest constitutional symptoms will be such as point to the stomach; dyspepsia is seldom absent.

Progress of symptoms.

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* See case reported by Dr. Wilks, Guy's Hosp. Reports for 1852, p. 248, where a woman, who eventually died of apoplexy, had been under observation with albuminuria for ten years. The kidneys were granular.

After a time, the urine becomes decidedly, though not very highly, albuminous, and the patient sallow and cachectic. Pain in the loins sometimes occurs, though not often.

Stomach affected.

When the symptoms are more declared vomiting may frequently occur, and prove so obstinate as to give rise to an erroneous suspicion of disease of the stomach. It sometimes is accompanied with great loathing of food, pain in the epigastrum, and other signs of dyspepsia. In one case, under observation, the mere suggestion of food or the sound of the dinner-bell was enough to bring on retching. Dr. Roberts states that in such cases the vomited matters occasionally contain free ammonia, or evolve ammonia on the addition of liquor potassæ.

Patients with this disease seldom suffer from diarrhœa.

Dropsy often absent, sometimes considerable.

Dropsy is a symptom which, though far less constant than in other renal disorders, deserves a prominent mention in connection with granular degeneration. When it occurs it marks an advanced stage of the disease, at which the previously copious urine has become scanty. Many cases go through the course of the disease without any dropsical effusion. 19 out of 68 patients whose symptoms are detailed in the subjoined table went to their graves with granular degeneration, without dropsy at any period of the complaint. The first to occur is œdema, and it may be stated as a general rule, that if no œdema exist, there is no effusion in the serous cavities. Next to the cellular tissue, the pleural cavities are the most often affected, then the peritoneum; the pericardium rarely. The dropsy is most conspicuous in those cases—by no means infrequent—where the renal affection is conjoined with valvular disease of the heart. In such it is often difficult to say whether the heart or the kidneys deserve most blame. Under these circumstances, the œdema often becomes so great, that were the case uncomplicated, it might be put down as one of tubal inflammation.

Mental depression.

With the symptoms of granular degeneration must be mentioned, as among the less common, mental depression, sometimes with a lachrymose tendency. This may occur in persons who are without any of the more obvious symptoms, and be the first means of drawing attention to the state of the urine.

HYPERTROPHY OF THE HEART.

Its frequency.

One of the most frequent consequences of granular degeneration is hypertrophy of the left ventricle of the heart. In the 68 cases of which the details are annexed in the table, were 31 in which this change was sufficiently marked to call for notice at the post-mortem. This statement is exclusive of those in which the alteration was associated with valvular disease, or adhesion of the pericardium. An analysis of 250 cases of granular degeneration, drawn from the St. George's books, gave 48 per cent. as the proportion of cardiac enlargement.

Immediate cause.

This increase of bulk in the left ventricle was known to Dr. Bright, and was attributed by him to an alteration in the blood, which caused it to pass with difficulty through the capillary vessels, and thereby called for increased efforts on the part of the muscle. There can be no doubt that this explanation is founded on sound principles. It is not necessary to cite instances of the same sort of action under other conditions. It is well known that the passage of blood through the capillaries is hindered by the presence of matters which it ought not to contain. The retention of blood in the lungs, and its accumulation in the right side of the heart, is a familiar result of impeded respiration, and appears to be due to the presence in the blood of materials which should have escaped with the breath.

Rare, except with granular degeneration.

It is very rarely that simple hypertrophy of the left ventricle is associated with any form of renal disease, excepting granular degeneration. I have never seen an instance, though I am not prepared to say that it never happens.

The chronic nature of granular degeneration gives time for chronic changes, which can scarcely occur with the more rapid forms of disease. The adjustment of the strength of the ventricle to the condition of the blood is necessarily a work of time. It does not appear that the change is more than is called for by the wants of the system. It does not attract notice by its symptoms, though it is often very evident to auscultation.

ATHEROMA.

Generally present,

Another change in the circulating system which the disease appears to encourage or produce is atheroma. An analysis of the post-mortem examinations of 250 cases of the disease showed it to occur in sufficient extent to call for notice, in a proportion of 52 per cent.

especially in minute arteries; consequent hæmorrhagic tendency.

From whatever cause it arises, atheroma is especially a disease of age. Even though the kidneys be granular, if the patient die young, it is unlikely that there will be any conspicuous change in the larger vessels. I have notes of five persons, who died of granular degeneration under the age of thirty. In only one was there any atheroma visible to the naked eye. But as regards degenerative changes in the minute arteries, these, as can be seen in the pia mater and retina, occur at an early period, and probably with more uniformity. Consequent partly upon such alterations, there is a tendency to extravasation of blood, which, as will be presently noticed, is one of the most marked characters of the disease.

INFLAMMATORY ATTACKS.

Due to contamination of blood.

As always happens with albuminuria, whatever the condition of the kidneys, the sufferer is apt to pay his debt before it is due; to be cut off, as it were, before his time, by some intercurrent disease, to which his disorder renders him prone. His blood is charged with excrementitious materials, which the kidneys have failed to remove, and which act as irritants to certain tissues. There is a morbid tendency to inflammation. As a consequence of granular degeneration, the organs, which are thus disturbed, are not affected with the same frequency as with tubal nephritis. By far the most common disorder of an inflammatory kind, to which these patients are liable, is bronchitis,

Bronchitis.

Pericarditis common.

which happens in about a third of the number; next comes pericarditis. The proportion in the table, 16 in 68 cases, refers only to the existence of recent pericarditis. If old false membranes and adhesions had been included, the number would have been considerably greater. Pneumonia and pleurisy are far less common, both happening about equally often. Endocarditis, as indicated by soft vegetations upon the valves, has the next place in order of frequency. Unlike what occurs when the heart is affected by the rheumatic poison, the interior does not often take on the inflammatory action, simultaneously with the outer covering. In the cases from which the details of this account are drawn there was but one instance where inflammation of the valves and pericardium were found to coexist, in a recent state. Among the more rare affections consequent upon this disease are peritonitis, and a congestive or inflammatory state of some part of the mucous membrane of the bowels.

Pneumonia, pleurisy, and peritonitis rare.

It will be seen from these statements that inflammatory affections are much less frequent than with nephritis, and that different organs are selected. Bronchitis, indeed, is common in both. Pneumonia, pleurisy and peritonitis, are characteristic of the more acute disorder; pericarditis of the chronic.

HÆMORRHAGIC ATTACKS.

Their immediate causes.

Perhaps, partly in consequence of the state of the arteries, which the chronic renal disease produces, and partly on account of the deficiency of fibrine in the blood, there is a marked hæmorrhagic tendency in confirmed cases of granular degeneration.

Epistaxis.

Bleeding from the nose often happens, and sometimes proceeds to an alarming extent. This symptom seldom occurs in connection with either of the other forms of renal disease.

Hæmatemesis.

Vomiting of blood is also not infrequent; it appears to be poured out by the coats of the stomach, without obvious breach of surface.

Apoplexy.

The most disastrous way in which the hæmorrhagic disposition shows itself is by extravasation within the skull. In the table which follows, there are three instances in which persons who were under treatment for granular degeneration of the kidneys were attacked with sanguineous apoplexy. But this statement gives a very imperfect idea of the alliance between the two diseases. The table includes only patients who were under observation with recognised albuminuria, and who had generally sought admission because the disease was manifesting itself by symptoms of a chronic kind, tending probably to some other ending. Those who die of apoplexy are apt to be struck, not in the wards of a hospital, but while they are going about making use of what health they have.

General association with granular kidneys.

If we look at the relationship in another direction, and consider the state of the kidneys in all who have died of apoplexy, we shall find facts which may throw light on the question. During the course of 20 years, 75 victims of apoplexy were examined in the dead-room at St. George's; of these 31 were described as having the kidneys in a decided state of granular degeneration. Mr. Thomas Jones has also examined the hospital records, from the apoplexy point of view, and I am able to add his testimony on this question. Mr. Jones states that of 36 cases of fatal apoplexy, in which the post-mortem examination was made with sufficient completeness to allow of conclusion as to the state of the kidneys, there were 29 in which those organs were extensively diseased. In 24, the organs were described as being small, hard, granular, with their cortical substances diminished—in some instances to the thickness of a shilling. Hence, it appears that it is rather under the fact to state, that of fatal attacks of apoplexy, one half are preceded by granular degeneration of the kidney.*

The renal disease induces the cerebral mischief.

Immediate causes of apoplectic tendency.

We can recognise three circumstances consequent upon granular degeneration, which must assist in causing rupture of the cranial arteries. The vessels themselves are weakened by atheroma. The force of the left ventricle is increased by hypertrophy. The pressure of the blood upon the arterial walls is further increased by the obstruction in the capillaries, consequent upon the alteration in the blood. The last cause is less evident to the senses than the others, but it is hardly possible to doubt its existence.

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* See papers on Apoplexy, by Mr. Thomas Jones, British Medical Journal, 1862.

Affection of retina.

Another result of the same chain of circumstances is to be found in the derangement of vision which so frequently accompanies granular degeneration of the kidney. Like epistaxis, apoplexy, and other hæmorrhagic attacks, it is associated with the degeneration and rupture of minute arteries.

Especially belongs to granular degeneration.

In the 68 cases of granular degeneration of which the symptoms are given in the table, there are 5 in which dimness of sight or total blindness followed, as a consequence of the disease. A connection between albuminuria and amaurosis has long been recognised. As is the case with apoplexy, the retinal change which resembles apoplexy in its mode of origin is especially associated with granular degeneration. In my own experience I have never known amaurosis to occur in connection with kidney disease of any other kind. As far as I am aware, there is but one published case in which amaurosis has been traced to either of the other forms of albuminuria. In the exceptional case, the characteristic affection of the retina was associated with a pale and fatty kidney, apparently such as belongs to nephritis,[*] though it was not examined minutely enough to place its condition beyond doubt. In all the remaining cases in which the state of the kidneys was ascertained, 18 in number, granular degeneration was distinctly described.[†]

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[*] Dr. Allbutt, Med. Times, May 11, 1867.

[†] The cases referred to were derived from the following sources:—5 are contained in the author's notes, and are referred to in the subjoined table; 3 are recorded in the St. George's post-mortem books; 4 are recorded by Landouzy (Gaz. Med. Paris, 1849); 1 by Bright (Guy's Hosp. Reports, 1840); 1 by Gull (Med. Times, 1865); 1 by Hutchinson (Med. Times, 1865); 2 by Hulke (Ophthalmic Hosp. Reports, 1866); 1 by Roberts, p. 352. In all these cases which, with the exception mentioned, are all I have been able to discover in which the retinal affection existed during life, and the kidneys were examined after death, the kidneys were described as decidedly granular, often as atrophied and containing cysts.

For a full description of the morbid changes in the eye, under the circumstances, I must refer to works upon ophthalmic medicine. The few opportunities which I have had of examining, after death, the eyes of persons who have had the affection in question, are no more than sufficient to enable me to confirm in a general way what has been stated by authors who have made an especial study of ophthalmic pathology.

Changes in retina.

It appears that the retina and the optic nerve become infiltrated with serum. The retina opposite to the attachment of the nerve becomes tumid and of a whitish grey colour. The capillaries become dilated and thinned, while the coats of the small arteries are often thickened. Minute or somewhat extensive extravasations of blood are apt to take place within the thickness of the retina. The connective tissue becomes thickened and altered, as do the nerve fibres. A beautiful plate of the appearance of the retina, as seen through the ophthalmoscope, is given in Leibreich's work, and I may refer also to a paper by Mr. Hulke in the Ophthalmic Hospital Reports for January 1866.

Affection of sight.

The white patch upon the retina, opposite to and around the entrance of the optic nerve, variegated by spots of extravasated blood, is so characteristic that persons familiar with the use of the ophthalmoscope are often enabled at once to refer the change to renal disease. Dimness of vision is more often produced than total blindness. The latter symptom only occurs after a long persistence of less complete obscuration. The destruction of vision is very gradual.

Dimness of sight is not infrequent with the albuminuria of pregnancy, a condition which has been shown to be related to the granular or intertubular disease.

URÆMIC POISONING.

Natural ending by head symptoms.

When all the accidents of the disease have been escaped; when the patient has not been cut off by bronchitis or any other form of inflammation, by apoplexy, or by any other of the dangers which beset his course; when the disease reaches its natural ending, the ending to which every case will arrive if the disease go on long enough, it will terminate by way of 'head symptoms.'

It will be seen that each form of renal disease affects the nervous system in a manner somewhat peculiar to itself. Whatever the symptoms may be, they depend primarily upon the altered condition of the blood. Insomuch as the gland is differently altered in each case, it may fail in regard to different constituents of the urine. For instance, the large white kidney fails to remove the water, which with the granular kidney is abundant. Other elements of the urine may also vary, so that with each variety of renal disease we may have the blood poisoned in a somewhat different manner, while the cerebral symptoms which result differ accordingly.

Coma, rather than convulsion, preceded by sickness.

With nephritis the tendency is to convulsive seizures; with the granular kidney the tendency is to a gradual access of tranquil semi-coma. Convulsions sometimes happen, but in the majority of cases the symptoms are of a quiet kind. They generally come on slowly, and are apt to be preceded by vomiting. The patient, who has perhaps been sick after all his meals for some time past, begins to find that he is drowsy or restless; that he has headache, giddiness, or a feeling of stupidity. It may be noticed that his manner has become peculiar. He may have wandering and delirium, though the latter condition is comparatively rare. After the occurrence of one or more of these symptoms, or without any warning, the patient may pass into a quiet stupor, in which he will lie regardless of passing events, but capable of being roused by loud or repeated questions. This state of quiet stupor is very characteristic of renal disease. The pulse is quiet, the skin cool, the pupil dilated, or natural. There is a peculiar stertor, which increases as the end draws near and the insensibility deepens. This has been described by Dr. Addison.* The respiration is generally quick, and is accompanied with labial rather than guttural sounds. Instead of the snoring stertor which follows sanguineous apoplexy, the sounds are of a hissing character, to use the expression of Dr. Addison,

Premonitory symptoms.

Characters of the stupor.

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* Dr. Addison, Guy's Hospital Reports for 1839, p. 3.

and are produced by the mouth and lips rather than by the throat and nose. There is no localized paralysis, no inequality between the two sides, but general immobility and torpor.

Sometimes convulsions.

This condition may be preceded or interrupted by convulsions of an epileptic character. Such seizures occur in a large minority of the cases. When present they do not differ from the convulsive attacks which belong to other forms of renal disease.

Attacks sometimes sudden, often like narcotic poisoning.

In some cases coma, or more rarely epileptic convulsions, come on almost suddenly, while the patient is about his usual occupations. It sometimes happens that persons fall down in the streets from this cause. All symptoms of renal disease may hitherto have escaped notice, and the patient may have considered himself well until within a few hours of his death. In such cases the disease may be mistaken for drunkenness, or some other form of narcotic poisoning. The less profound insensibility, the different character of the stertor, and the dilated pupil, must be relied upon as means of distinguishing renal coma from poisoning by opium, while the contents of the stomach and the odour of the breath will give evidence of liquor, should the symptoms be due to drunkenness. In a doubtful case the urine must of course be obtained by means of a catheter, or otherwise.

It must be observed that patients with granular kidneys are likely to become poisoned by very minute doses of opium. In such cases it is extremely difficult to say how far the symptoms are due to uræmic poisoning, and how far to the apparently insignificant dose of the narcotic which the patient has taken.*

State of brain.

The condition of the brain after death, under such circumstances, is one which may be briefly described. The noticeable fact about it is extreme anæmia. The large vessels are empty, the grey matter blanched to a pale buff, while the white matter is perfectly colourless, no blood, or scarcely a trace of blood, exuding upon the cut surface. There is often slight excess of watery fluid in the various cavities and interstices;

Bloodless, watery.

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* See cases reported by Dr. Roberts, op. cit. p. 350.

the ventricles and the subarachnoid space contain a little more than usual, but not so as to produce any pressure upon the cerebral substance. The sulci are generally deep, the convolutions prominent, quite unlike their condition when any pressure is exerted from within. The brain is generally firm, as in health.

The anæmic condition of brain which is so evident after death has no doubt a share in the production of the symptoms.

Analysis of 68 *Cases of Granular Degeneration under the observation of the Author, and attested by post-mortem examination.*

Causes, showing number attributed to each		Consequent affections, how often present	
Valvular disease of Heart	6	Hæmaturia	10
Pregnancy	1	Frequency of Micturition	13
Gout	16*	Pain in Loins	9
Occurring in printers or compositors	10	Œdema	49
		Ascites	18
		Hydrothorax	23
		Fluid in Pericardium	3
		Purpura	0
		Erysipelas or Inflammation of Cellular Tissue	3
		Uræmic Convulsions	11
		Simple Coma, or semi-coma †	14
		Other head symptoms (neither fits nor coma)†	13
		Pneumonia	7
		Pleurisy } Present in a recent state at time of death.	7
		Peritonitis	3
		Pericarditis	16
		Endocarditis	4
		Bronchitis	24
		Vomiting (not bloody)	17
		Diarrhœa	2
		Congestion, or inflammation of bowels	3
		Amaurosis, or dimness of vision	5
		Sanguineous Apoplexy	3
		Epistaxis	4
		Vomiting of Blood	3
		Hypertrophy of Heart, without valvular disease or pericarditis	31
		Atheroma	14

* 3 of which associated with lead. † No convulsions occurring in these cases.

Cases excluded where the symptoms of valvular disease have predominated.

In patients with granular kidneys, as already stated, attacks of sanguineous apoplexy are common. The symptoms need not enter into consideration here, as they are of the well-known and ordinary sort. The occurrence of hemiplegia will be sufficient to distinguish such an attack from an uræmic seizure. In the latter condition, hemiplegia is never observed, the limbs are equally useless on each side, and the face and eyes remain perfectly symmetrical. The quiet pulse, pale face, and peculiar stertor of renal coma are further points of difference.

Uræmic attacks distinguished from apoplectic.

URINE IN GRANULAR DEGENERATION.

The urine is affected in this disease in a manner precisely the converse of what happens with tubal nephritis. It is increased in quantity in the early and middle stages—even to 90 oz. in the 24 hours—and if scanty at all, only so after the disorder has lasted a considerable time.

First increased, then diminished.

The urine is usually bright and clear, perhaps paler than its dilution would seem enough to account for. In the later stages, when scanty, it is sometimes turbid from urate of soda, but in the majority of cases it remains clear. Sometimes it has a peculiar whiteness, not turbid, but not quite transparent.

Appearance.

Early in the disease the urine is free from both albumen and casts. Then a few casts are to be found under the microscope, of a coarse granular texture; and when these have for a time constituted the only direct evidence of the disease, a trace of albumen appears, which afterwards increases, but not to the amount found with the more acute disease.

Casts before albumen.

Albumen at first small.

The specific gravity is generally below the natural standard, varying from 1007 to 1015. It may be, however, where the urine has been diminished in quantity by the occurrence of renal catarrh, as sometimes happens towards the close, that the specific gravity may surmount by several degrees the limit mentioned. As far as my experience has gone the maximum is 1030.

Specific gravity.

As a rule the acidity of the urine is lessened.

Acidity.

Blood.

Blood is passed as a result of this disease, but with much less frequency than in the more acute disorder. About one case in ten was found, while in hospital, to pass enough blood to be evident to the naked eye.

Casts.

When the urine is allowed to stand, casts may generally be found, but in no such abundance as characterises ' nephritis.'

So long as the disease is running its course uncomplicated by catarrh of the tubes, and without hæmorrhage, the microscopic sediment will consist only of casts. There is no renal epithelium, nor any pus, such as is apt to result from its transformation.

Characteristic granular.

The casts which especially belong to this disease, and may perhaps be regarded as peculiar to it, are of coarse granular texture, large, opaque, and conspicuous. These, which are well represented in the plate, are almost invariably present, if casts are present at all.

Consisting of altered fibrine.

To hazard a conjecture as to their composition, they may consist of fibrine which has been broken into fragments, or completely disintegrated into a granular débris by changes which it necessarily undergoes during its slow passage along the renal ducts. Acetic acid makes these casts translucent, and often shows fragments of fibrine in them. Fibrine if allowed to decompose in water breaks down into a coarse granular material closely resembling the casts in question. The granular casts which are found in nephritis, and are composed of altered epithelium, are totally different in appearance.

Tubal catarrh a late complication.

Beside these casts, others are very often present which consist of fibrine in its natural transparent condition; but since such casts occur with every variety of renal disease, they are of less diagnostic importance than the dark granular variety.

Granular degeneration sometimes becomes complicated towards the close of the disease, with more or less of tubal catarrh. This intercurrent disorder may be recognised by the nature of the urinary deposit, as well as by the scantiness of the urine and the tendency to dropsy. It may be presumed that this condition is at least partially present when

Plate 7.

Casts: Granular degeneration.

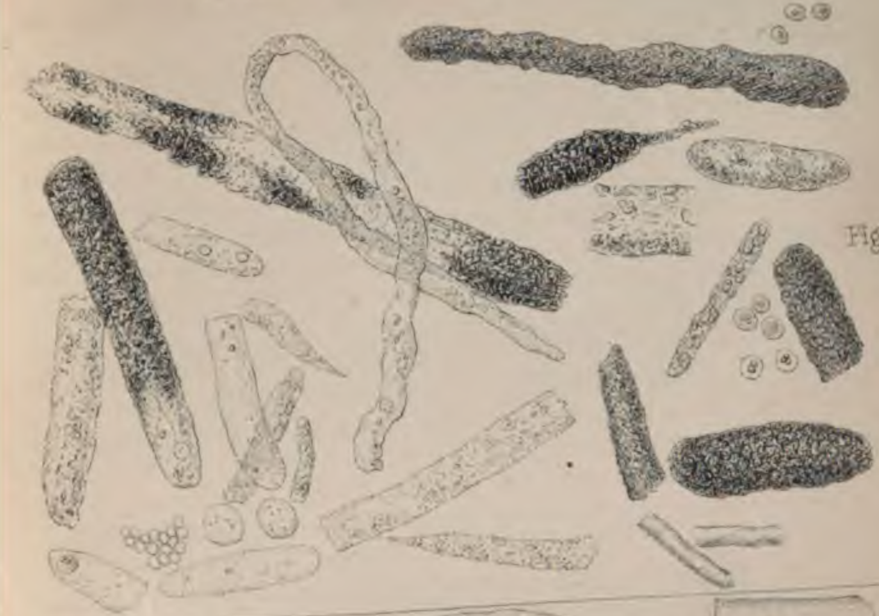

Fig. 1.

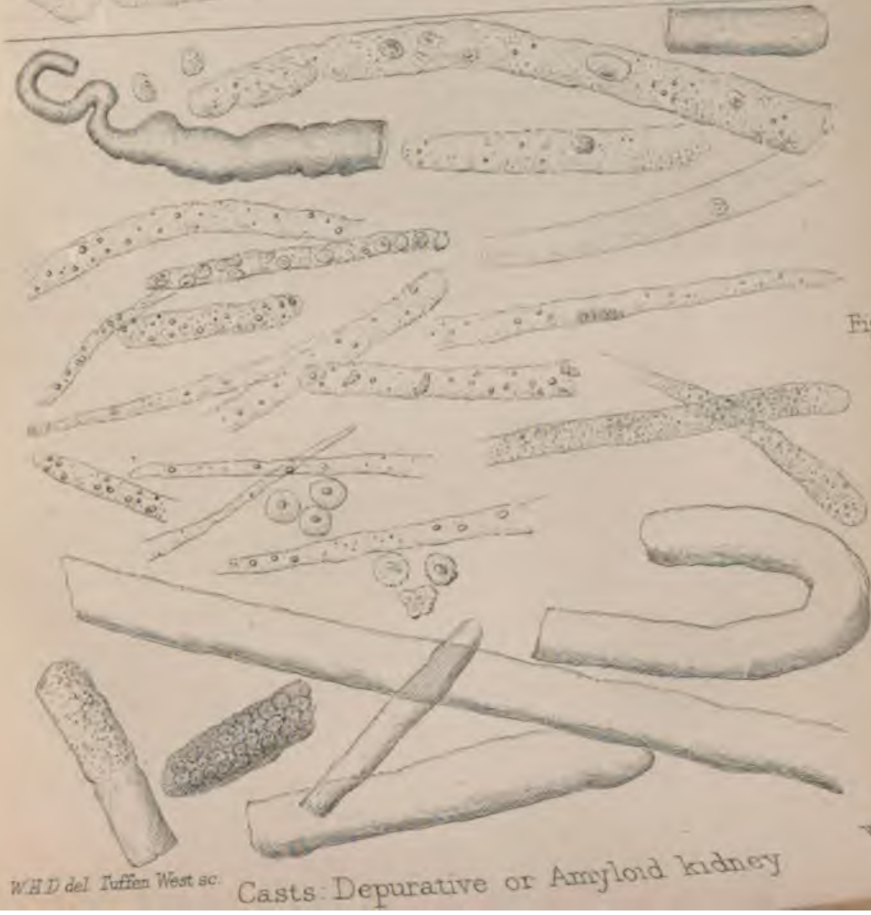

Fig. 2.

W.H.D del. Tuffen West sc.

Casts: Depurative or Amyloid kidney

epithelial cells are shed. When this is the case the cells are found as a loose deposit, either in their natural state, or with more or less of the character of pus, beside which some of the casts will imbed cells of the same kind. The casts in such cases are of a mixed sort; some coarse, granular, or simply fibrinous, while others are of the epithelial variety, such as belongs to the tubal disease.

Chemical Changes in the Urine.

Water increased, at last diminished.

Water.—Increased, except in the later stages of the disease, often up to 90 oz. Towards the end the quantity frequently falls below the natural standard. It may even be reduced to 6 or 7 oz. This is characteristic of a very advanced period.

Urea diminished.

Urea.[*]—Invariably reduced, though not to a great extent until a very advanced condition of disease is reached. In a case under my own care, I traced the diminution of the urea as the disease approached its end, from 23·0 grammes to 8·7 in the 24 hours. The disease may be present for a long time without much diminution of urea, if the urine remain copious. Towards the close, however, the diminution may be extreme. Two cases of the disease are recorded by Rosenstein,[†] both attested by a post-mortem examination, in which the daily amount of urea fell, before death, in one case to 3·5 grammes, in the other to the exceedingly small amount of 1·0 gramme. This is the extreme of diminution; a more usual reduction is that given by the same author in another fatal case (Wilhelmina Karsten),[‡] when the quantity varied from 19 to 12 grammes. From these facts it appears that the variations of urea do not differ much from what takes place with tubal nephritis.

Sometimes extremely.

Uric acid, various.

Uric Acid.—In the slighter forms of the disease but little reduced. In the more advanced stages totally absent.

Phosphoric acid reduced much.

Phosphoric Acid.—Always diminished, much so towards the end. Generally reduced to from half to a quarter of its normal amount. In one case under my own care it fell to ·087 grammes before death. This is the lowest amount I have observed in this disorder.

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[*] For the normal amount of the constituents of the urine, see note page 44.

[†] See Rosenstein, cases of W. K. Getz, p. 121, and Fred. Jauzen, p. 192.

[‡] Ibid. p. 153.

Sulphuric acid reduced little.

Sulphuric Acid.—This acid is reduced, but to a much less extent than the phosphoric. It is usual to find that, contrary to what is the case in health, the sulphuric acid is more abundant than the phosphoric. In the case alluded to above, near the end of the disease, the sulphuric acid was in five times the quantity of the phosphoric.

Chlorine reduced.

Chlorine.—Affected much as the sulphuric acid. Except in the later stages of the disease, where the urine has become scanty, the chlorine, or chloride of sodium, is little altered. Towards the close the chlorine fell, in the case already referred to, as low as 1·13 grammes. In a case recorded by Rosenstein, the chloride of sodium reached a minimum of 0·7 grammes. In both these cases the urine had fallen much below the usual quantity.

Little observed.

The Alkalies and Earths.—The variation of these constituents is imperfectly known; all that is ascertained is that the mineral components of the urine are generally reduced, but since the urine is reduced in acidity it must be supposed that the acids suffer most diminution.

Albumen.

Abnormal Constituents.—The occasional presence of blood has been already discussed. It is not necessary to say more about the albumen than that it is often absent during the earlier stages of the disease, and subsequently may be present only in very small quantity. Sometimes it is copious, but it seldom reaches the amount seen with tubal nephritis. It does not appear that the stage or extent of the disease can be judged of by the amount of this substance. The kidney may be extremely disorganised, while the albumen only amounts to a trace. In some cases, where it has been abundant during the progress of the disease it diminishes towards the close. The amount depends much upon the association of tubal inflammation with the intertubular disease.

Uncertain in amount.

Summary of chemical changes.

Stating shortly the chemical changes which the urine undergoes in granular degeneration, they are these. The water is increased except in the later stages of the disease; then it is diminished. The urea, the uric acid, and the phosphoric acid, are reduced, but not to a great extent, until the urine has become scanty and the end approaches.

The sulphuric acid and the chlorine are diminished, especially towards the last, but these substances are less influenced by the disease than are the other components of the urine.

Albumen not invariably present, variable in quantity, often in small amount.

CASES.

The following cases are appended as illustrations of the course and symptoms of granular degeneration.

Granular Degeneration coming on without ostensible cause. Symptoms chiefly referred to the stomach. Urine albuminous, increased in quantity, and containing coarse granular casts. Almost total absence of Dropsy. Convulsive attack. Gradual sinking, with serous effusion into the lungs. Post-mortem examination.

William Tugwood, twenty-five years of age, a farm labourer, was admitted by Dr. Pitman, December 5, 1860.

He had long been insufficiently fed, living chiefly on toast and tea. Three years ago he began to suffer from vomiting, generally before breakfast. He had no other ailment, until four months before he came in, when he noticed that the ankles were, for a short time, œdematous. He never observed anything unusual in the appearance or quantity of the urine, nor had nocturnal micturition, nor pain in the loins. The cause of the disorder could not be ascertained. He had never had scarlatina. The illness could not be traced to any exposure to cold. He was not gouty. When under observation his chief complaint was of vomiting. The face was sallow and somewhat puffy, but there was no œdema on any part of the person, nor was there any evidence of fluid in the chest or peritoneum. A faint systolic murmur was heard all over the heart, its point of greatest intensity being at the base on the right of the sternum. There was no increase of impulse or dullness on percussion. The urine was passed in large quantity (56 oz. in 24 hours). It was pale, having a whitish colour, faintly acid, sp. gr. 1010; albumen = $\frac{1}{4}$. Under the microscope were seen a great number of opaque granular casts, of a sort very characteristic of granular degeneration. They were coarse and black. Acetic acid made them translucent, with an appearance as if compacted of fragments of transparent material, like fibrine broken up into small pieces.

He went on without much change until the 12th, when he complained of feeling chilly all day, and at night had a convulsive seizure, in which he bit his tongue. For a time afterwards he remained unconscious, and next morning he was drowsy, and had pain in the head. He had a blister upon the back of the neck, and was freely purged. The sickness continued, and he remained dull and heavy. The urine now (December 17) was alkaline; it contained dark granular casts of the kind seen before, beside some of smaller size composed of uniform translucent fibrine. It was less copious. Albumen = ½. He now began to cough and expectorate, and had an appearance of depression and prostration which had been coming upon him ever since the convulsive attack. He was cupped upon the chest without relief to the cough, and he gradually sank and died. He retained his consciousness to the last.

Post-mortem examination.—The body was free from œdema, and in moderately good condition. There were traces of a pustular eruption.

The kidneys were of about the natural size, weighing together 12½ oz. The capsules were somewhat adherent and opaque. Their surface was beset with large white granulations, which stood upon a ground of a whitey-brown colour. The shape was rather irregular, a long depression occupying the central part of each. On section, the cortex appeared of a whitey-brown colour and coarse texture. It was irregularly diminished. The cones were paler than natural.

Examined with the microscope, there was found to be a general increase of fibrous tissue, especially around the malpighian bodies, which were shrunken. The convoluted tubes had lost their regular arrangement of epithelial cells, but were filled with indefinite granular matter, in which epithelial cells were visible, and also oil globules. The straight tubes contained matter of the same sort, but more completely broken down, and resembling closely that which had formed the casts. The epithelial cells, from whatever part of the kidney they were taken, were perfectly natural. They were free from oil.

The brain, with its vessels and membranes, was perfectly healthy, as was the medulla oblongata.

There was a good deal of fluid, with partial adhesions, in both pleuræ. The lungs were loaded with frothy fluid. The heart was natural.

All the abdominal organs were natural excepting the kidneys.

This case is very characteristic. The symptoms began in an indefinite manner, and without assignable cause. Gastric disturbance, vomiting, due not to intolerance of food but occurring chiefly before meals, was a source of distress for many months before any other functions were conspicuously impaired. This is one of the peculiarities of the disease while the almost total absence of dropsy is equally characteristic. The abundance of the urine, and the dark granular casts which it contained, supplied further arguments in favour of the belief that the kidneys were of the granular type. The patient was younger than most of the victims of this disease, but everyone who has seen much of the disorder will be able to recall instances where it has come on apparently spontaneously between 20 and 30, and when the symptoms have been such as are related in this case. The murmur was probably anæmic.

Granular Degeneration of the Kidneys. Profuse pale albuminous Urine. Thirst. Vomiting. Loss of Appetite. Emaciation. Absence of Dropsy. Mental depression. Epistaxis. Convulsive attacks, coma, death. Post-mortem examination.

Henry Todd, thirty-nine years of age, came into the hospital, under Dr. Page, April 11, 1860.

For the preceding two years he had noticed a great increase in the quantity of the urine, especially in the night, during which, as he said, he passed nearly a gallon. For the last six months he had been unable to follow his occupation, that of a painter, in consequence of weakness and lowness of spirits. He had no more definite ailment until he became subject to vomiting two months before his admission. He usually vomited after meals, the food coming up half digested. He had never had any œdema. He had always been temperate in matter of drinking. He had a deep sallow colour, which formerly was not the case. He was emaciated and sharp-featured. The legs were thin and free from œdema, as was every other part of the body. There was no pain or tenderness in the loins, nor had there ever been. The skin was always dry. He had excessive thirst, always sleeping with a jug of water by his bedside, and there was total loss of appetite. A few spots of acne were scattered over the back. He was very dolorose, often shedding tears. The tongue was broad, tremulous and coated. The pulse 90. The bowels were habitually confined. The urine was copious, 58 oz.

in 24 hours. It was acid, pale, sp. gr. 1011. Albumen=¼. After subsidence many coarse dark-brown granular casts were found, such as are represented in plate 7. Beside these, many cells of renal epithelium were seen, and some cells which, with acetic acid, showed the compound nucleus of pus.

The treatment consisted of an occasional aperient, and a draught containing quinine and acid. The vomiting was treated unsuccessfully, with nitrate of bismuth, hydrocyanic acid and soda, brandy and ice. He had while in the hospital several attacks of bleeding at the nose.

On April 25, being apparently in much the same state as when admitted, he had two well-marked epileptic fits, close together, followed by insensibility which lasted for about a quarter of an hour. He appeared to recover his former condition under the action of wine and ammoniacal stimulants, but on the evening of the next day he became restless, and passed a little blood with a motion. Next morning, April 27, he gradually became insensible, with involuntary evacuations and some distortion of the eyes. In the afternoon he died comatose.

Post-mortem.

At the post-mortem examination it was found that the kidneys were much shrunk; the pair weighed only 6 ozs. The capsules were thick and adherent, the exposed surfaces were covered with large distinct white granulations. On section the cortex was exceedingly diminished. It contained several cysts, the largest of which was the size of a walnut. There was a good deal of fat around the pelvis. The artery and vein were measured in one of the kidneys, at a point between the union of all the branches from the gland and the junction with the aorta and vena cava. The internal circumference of the artery was 0·37 inches, of the vein 1·0 inch. It was found by many observations that the range of the artery in health is from ·45 to ·75, of the vein from 1·07 to 1·52. The artery was therefore considerably narrowed, the vein somewhat.*

The brain was pale and watery, but in other respects natural. The heart was of very large size, weighing 24¼ ozs. The increase was principally in the left ventricle, the cavity of which was dilated, while the wall was exceedingly thick. All the valves were natural. The aorta was slightly athermatous.

The lungs were perfectly natural, as was the stomach and all the abdominal organs, with the exception of the kidneys.

Comments.

With the symptoms which were present in this case it would be impossible to doubt the nature of the disorder. The case is typical. The symptoms belonging to other forms of renal disease were absent, while those of granular degeneration were prominently displayed. The man was a painter, a fact of itself enough to suggest the nature of his disease. The urine became unnaturally copious; this, as it often is, was the first symptom which attracted his attention. It was pale, of low specific gravity, and contained coarse dark granular casts—particulars which, though not peculiar to granular degeneration, seldom fail to be associated with it during some part of its course. There was a total absence of dropsy. The sharp attenuated appearance of the patient was very unlike the bloated look which persons who suffer from kidney disease of another sort are apt to have. His sallow discoloured face would have made a contrast with the white pallor of the more acute disease. The urgency of the stomach symptoms is another characteristic, as also is epistaxis. The termination of the illness by cerebral symptoms is what might have been expected from the persistence of vomiting. The mental depression and lachrymose tendencies of the patient belong especially to this disease. It may be believed that the ancients, including in that term all who preceded Dr. Bright, attributed to the liver and spleen many symptoms which belonged to the kidneys. Few diseases are more productive of melancholy than granular degeneration.

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* Paper by the Author, Med. Chir. Trans. vol. xliii. p. 244.

The following case is similar in some respects.

Granular Degeneration; insidious approach with alteration of temperament. Paraplegia. Total absence of Œdema. Death from an Apoplectic attack. Examination of Kidneys.

During the last twelve months I frequently visited, in company with Mr. Hatherly, who had charge of the case, a literary gentleman who is the subject of the following account.

This gentleman, who was of spare figure, and of active and abstemious habits, underwent of late years a gradual alteration in temperament which made his friends apprehensive of mental disease. He became depressed in spirits, prone to tears, and unnaturally irritable in temper. He found himself disposed to take alcoholic stimulants in much larger quantities than heretofore. He became weaker and somewhat thinner than usual; and frequently complained of pain in the loins, which was thought to be rheumatic.

His intellect remained clear and vigorous, and he continued to pursue his avocations, though with fatigue and difficulty.

One Sunday during September, 1866, while walking home from church, he suddenly became incompletely paralysed in the lower limbs, so that he staggered in his gait. He reached home with some difficulty, and was seen the next day by Mr. Hatherly and myself. There was then a want of power in both legs, such that he could only walk a few steps, and that with staggering and difficulty. There was decided numbness in the affected limbs, and there was retention of urine. There was a sensation, not amounting to pain, without tenderness, in the lumbar region of the spine.

The complexion was pallid and somewhat sallow. The skin was cool, the tongue clean, the pulse slow (60). There was no trace of œdema. There was no history of gout. It was stated that for some time past the urine had been passed in increased quantity, and with frequency, especially at night.

Some which had been drawn off with a catheter was examined; it was albuminous (albumen $=\frac{1}{12}$), sp. gr. 1014. It was natural in colour and acidity. Under the microscope a number of very transparent casts, some faintly granular and some dotted with oil globules, were seen. There were also crystals of uric acid.

It was sufficiently clear that this gentleman was the subject of granular degeneration of the kidneys. This view was communicated to his family, with a warning as to his precarious tenure of life. The paraplegia was regarded as secondary to the renal disease.

Iodine liniment was now applied to the spine; the bowels were relieved by medicine; and a mixture containing iron and phosphoric acid was given, to which after a time strychnine was added.

The paraplegia gradually diminished, though it never entirely disappeared, and the patient resumed much the same state of health as before the attack. He further improved under the use of weekly vapour baths, and showed so little outward sign of illness that his relatives were inclined to hope that an erroneously grave view had been taken of the case, and quoted, or perhaps I should say misquoted, in support of this hope, the opinion of a medical friend to the effect that 'the urine contained no more albumen than it ought.'

The urine, however, continued as described; the quantity of albumen and the nature of the casts underwent no change.

As the following summer approached he expressed himself as not feeling so well as in colder weather, and the stomach became irritable, insomuch that he vomited occasionally after meals. The end came suddenly. One morning in June, when he was thought to be unusually well, and was preparing to go a short distance into the country, he was found on the floor of his bedroom helpless and speechless, but not quite insensible. He had vomited. He was found to have lost the use of the left limbs. He rapidly became quite unconscious, with stertorous breathing, and died about two hours after the beginning of the attack. He had no convulsion. He died at the age of fifty-two.

Post-mortem

Permission was obtained to examine the kidneys, but it was not possible to open either the head or the spine. The body was lean, there was no trace of œdema.

The kidneys were surrounded by adherent cellular tissue and fat. The capsules were closely adherent, so much so as in some places to tear up the surface. The organs were shrunk to about half their proper weight. Their surfaces were covered with closely set granulations, small but very distinct.

On section the cortex appeared to be much wasted. The bases of the cones in some places almost touched the surface of the kidney, while in most parts not more than the thickness of a shilling intervened. The cones themselves were sprinkled with white specks of urate of soda. A few small cysts appeared both in section and on the surface.

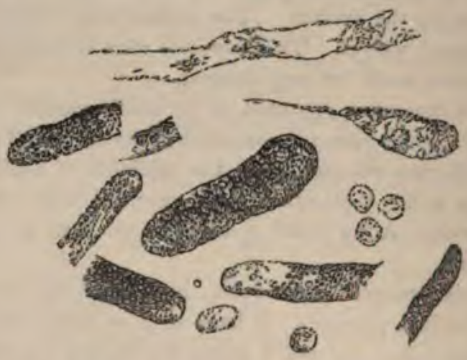
Comments.

This case is somewhat remarkable, in consequence of the intercurrence of spinal paralysis. I have seen no other case in which this has taken place, nor am I aware that such a complication has been recorded. Although the cord could not be examined there is little doubt that the lesion was a small extravasation of blood within its substance. The same tendency showed itself in a more fatal form in the final apoplectic seizure. Both occurrences were results of the general arterial degeneration which accompanies the renal disease. That the final seizure was dependent upon extravasation is rendered probable by the presence of hemiplegia, which does not occur from mere uræmic disturbance. In the absence of dropsy the case is characteristic, and scarcely less so in the mental depression. The kidneys were truly gouty; they contained urate of soda, though no gout had shown itself externally.

In the following case the apoplectic tendency of the disease is also prominently displayed.

Granular Degeneration of the Kidneys. Occasional Œdema. Characteristic Urine. Successive Apoplectic attacks. Post-mortem examination.

John Shave, fifty-two years of age, was admitted at St. George's Hospital, November 3, 1858. He was a hotel-porter, a temperate person, as he said; in the habit of drinking 'only small beer.' He was under the care of Dr. Bence Jones. Two years before he had had an attack of illness with much swelling of the legs, but there had been little œdema since. Three days ago he had been attacked with vomiting, and had since had headache, nausea, and pain in the loins. He denied having had any fit, but his statements, from his uncertain state of mind, could not be depended upon. He was pallid, but there was no œdema. For several days after admission he remained in a sluggish condition, with a peculiar heavy manner, unwilling to speak, but answering rationally when roused. He complained of constant pain across the forehead, and also in the loins; the latter of a very superficial character and affected by movement or pressure. All the limbs could be used, the arms however with slowness and apparent difficulty; there was a loss of sensibility in both hands, and to a smaller extent in both forearms.



Granular Casts and Cells of Renal Epithelium. From case of Shave.

The fæces were passed into the bed, and the urine upon the floor, apparently by choice. Enough was disposed of in this manner to prove it to be very copious. Some which was obtained was pale, clear, and albuminous (albumen $= \frac{1}{3}$). Acid, sp. gr. 1015. It contained numbers of coarse dark granular casts, of a kind very characteristic of granular degeneration. The tongue was white and tremulous, the pulse 76, full and soft. Cold lotions were applied to the head, a blister was put upon the neck, and a simple saline draught was ordered. Under the influence of these remedies, with frequent purges of compound jalap powder, and latterly a mixture containing nitric acid and iron, he continued to improve, lost his peculiarities of manner and conduct, and almost regained his usual state of health. The urine (November 15) had the same characters, the albumen however being in smaller proportion. Casts of the same sort were seen, as well as others of a more transparent kind.

On December 28 he suddenly fell into a state of complete insensibility. When seen he was unconscious, no paralysis could be made out, but the left arm was colder than the right, and the left pupil was contracted to a mere point. One hand was kept upon the head, as if that were the seat of pain. The evacuations were passed unconsciously. The pulse was weak, 72. After active purgation a slight gleam of consciousness returned, but now (January 1) it was observed that both pupils were contracted, and the right eye squinted inwards. There was no paralysis of the limbs. He went on seeming rather to improve, until the evening of the 6th, when he had another fit, which caused his death before the following morning.

Post-mortem.

At the post-mortem examination the kidneys proved to be much shrunk. The capsules were thickened and adherent. The surfaces showed numerous light-coloured granules, of rather large size, set upon a purplish ground. On section there was a good deal of fat around the pelves. The cortex was diminished and contained many white spots, as if the same granules which appeared on the surface were scattered through the substance. There were also numbers of small cysts in the cortical part.

One of the kidneys was tested as to its power of conveying water by the vessels, in a manner already described. It was found that only about one-third of the quantity of water passed through the organ, which a healthy kidney should transmit under the same circumstances, the amount being 40 oz. 5 dr., against 119 oz., the average of health.*

The large arteries were visibly narrowed.

Under the microscope it was found that there was a general increase of the fibrous tissue of the organ, around the blood vessels and between the tubes. The tubes in the cortex were filled by dark granular matter, partly composed of closely-packed epithelial cells. The straight tubes, in some cases, had the same contents as the cortical tubes, while others contained transparent fibrine dotted with oil. Separate epithelial cells obtained from the cortical part were perfectly natural.

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* Med. Chir. Trans., vol. xliii. p. 243.

The vessels of the brain were extremely athermatous. There was a good deal of blood extravasated in the sac of the arachnoid, and in the subarachnoid space, over both hemispheres, at base and vertex. The white substance was firm and pale. The septum was pushed over considerably to the right side by a large clot in the left ventricle, which distended its cavity. The blood here was loosely coagulated and black. The right ventricle contained blood-stained serum, but no pure blood. In the right corpus striatum, at its upper and anterior part, was an old cyst, the walls of which were of a brownish colour and its cavity only just perceptible.

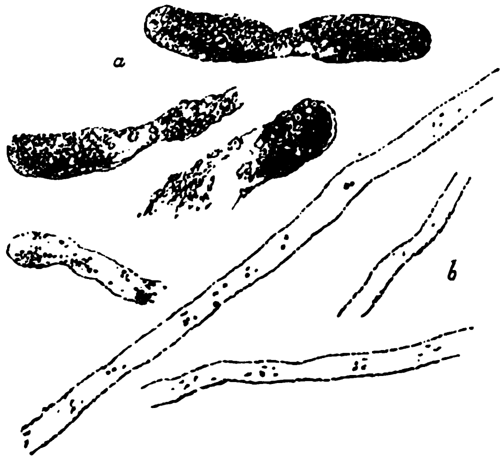
The heart was greatly hypertrophied, principally on the left side; it weighed 22 oz. The valves were healthy, as were the aorta and large vessels. The lungs were excessively congested. All the abdominal viscera were healthy except the kidneys.

Comments. This case exemplifies many of the symptoms and tendencies of granular degeneration. The abundant pale albuminous urine, the dark granular casts, the absence of œdema, all pointed to that condition. The head symptoms were shown by the post-mortem examination to have been due to a succession of extravasations of blood within the cranium, and they were such that they could scarcely have resulted from simple uræmia. The vomiting and pain in the head which occurred shortly before his admission probably marked the occurrence of the extravasation which was found upon the surface of the brain. This was spread equally over both sides, and therefore gave rise to no hemiplegia, but to loss of sensation and impairment of movement on both sides alike. The two apoplectic attacks which occurred during the last ten days of his life, and were accompanied by distortion of the right eye and contraction of the left pupil, were apparently due to a smaller and then a larger outburst of blood into the left ventricle. The old cyst which was found in the corpus striatum probably was of a date earlier than our knowledge of the case extended. The advanced atheroma of the arteries displayed in a marked degree one of the tendencies of the disorder. It probably occasioned or helped to occasion the hypertrophy of the heart, which itself must have been a potent agent in breaking the cerebral vessels and so causing the extravasations which led to the fatal result.

Granular Degeneration of Kidneys without Œdema or any obvious symptoms. Bronchitis. Emphysema. Convulsive seizures. Post-mortem examination.

Hubert Jutsum, forty-three years of age, a painter, of temperate habits, came into St. George's Hospital, September 21, 1859, under the care of Dr. Fuller.

He described himself as having had bad health for four or five years, though without definite complaint. He never had dropsy, nor pain in the loins, nor observed anything wrong with the urine; for ten years, however, he had had nocturnal micturition, passing water about six times in the night. This was the only evidence of renal disease that could be made out from his history. He was thin, and had a worn look. He had been subject for the last six weeks to long fits of suffocating cough, which, with difficulty of breathing, constituted his chief complaint. He could not lie down. On examining the chest, dry and moist bronchial sounds were heard generally. There was no expectoration. The urine was found to be profuse, pale, and clear; it was acid, sp. gr. 1014. It was albuminous, the coagulum about one sixth. Casts were found of two sorts, large dark granular and long narrow hyaline. Examined repeatedly, the same casts always recurred. Wine was freely given, with antimonial and stimulating expectorants. A blister was put upon the chest. The breathing gradually became worse, and on October 12 he had a con-



Granular and Hyaline Casts. From case of Jutsum.

vulsive fit, with a good deal of struggling. He remained afterwards in a condition of partial consciousness, sitting up in bed horribly restless, with cold extremities and a very weak pulse. On the 14th he was quite insensible, lying on his back, with sordes on the teeth and lips. He still swallowed stimulants which were liberally administered, and to the surprise of everybody he rallied for a few days. On the 28th, however, the difficulty of breathing increased, and with it the orthopnœa. On the 30th he had a second convulsive seizure, after which he remained insensible and gradually sank, dying on the following day.

Post-mortem.

At the post-mortem examination the body was found to be much emaciated, quite free from œdema. The heart was large, the left side especially much hypertrophied; the valves were healthy. The lungs were extremely emphysematous, and there was evidence of bronchitis. The kidneys were contracted, weighing together only 6 ozs. The surfaces were exceedingly granular, the capsules adherent, the cortices shrunk. They were typical specimens of granular degeneration.

The liver and spleen were small and hard. The supra-renal bodies, and all the organs which have not been mentioned, were natural.

The brain was not examined.

Comments.

The gradual failure of health, the pale albuminous urine, the character of the casts, the absence of dropsy, and last, not least significant, the occupation of the man, combined to declare the nature of the renal disease, which was clearly recognised during life. Emphysema of the lung, to which in this case many of the symptoms were due, is not a common complication of granular degeneration. The renal disease in this case had probably been progressing for many years, as appeared from the long continuance of nocturnal micturition, and from the fact that the change in the kidneys was such as could not have been produced in a short period.

Granular Degeneration associated with Gout. Unusual amount of tubal obstruction: consequent scantiness of the urine, and dropsy. Hæmaturia. Epistaxis. Dropsy excessive, leading to death. Post-mortem examination.

Benjamin Harvey, sixty years of age, a coal-heaver and a hard drinker, had become subject to gout about six years before his death, though for the last two years he had been free from it. The urine of late years had increased in quantity, so that, according to his own statement, he often passed a gallon during the night. It then suddenly changed in character, becoming deep in colour and very scanty, immediately upon which he became swollen, the ankles being first affected. The swelling, however, was not such as to incapacitate him altogether, and it was eight months after its appearance that he came into the hospital. He had never had pain in the loins. He was admitted under Dr. Bence Jones, October 31, 1860, who kindly gave me the treatment of the case.

The complexion was of a sallow, muddy colour. The legs and the lower part of the body were very œdematous; the legs below the knee were red, and denuded of cuticle over a considerable space, and discharged much watery fluid. The lower fourth of each pleural cavity was dull, and wanting in breath sounds. Where breathing could be heard there was small bronchial crepitation, and he had cough with expectoration of mucus. Pulse 92. The urine was passed with frequency, four or five times in the night, but in small quantities. It amounted to 24 oz. in as many hours, albumen$=\frac{2}{3}$, sp. gr. 1017. It was alkaline. It contained triple phosphate and pus cells, but no casts. He had ordinary diet with gin; the bowels, which were generally confined, were kept loose by means of compound jalap powder, and he took 12 oz. of decoction of scoparium with a scruple of iodide of potassium every day. The urine did not increase; it often came to no more than 12 oz. in the twenty-four hours, and the dropsy gained ground. Fluid appeared in the peritoneum, which with flatus caused great distention; he described himself as 'tight as a bottle.' The œdema increased and was somewhat relieved by careful acupuncture. Vapour baths were ordered, but did not cause much sweating. A variety of diuretics, including nitric ether, juniper, and cantharides, were given without effect. On November 28 he was attacked with profuse epistaxis, so that the nasal passages had to be plugged. He was much reduced by the hemorrhage, and was ordered gallic acid, with brandy. Coarse granular casts were now found in the urine, which previous examination had failed to discover. Under perchloride of iron and nitre the œdema diminished, the urine varying from 22 to 40 oz. in the 24 hours; the specific gravity ranging from 1015 to 1019. It was faintly alkaline, and as it had always been, of a natural yellow colour. On December 3 it was found to contain cells of fatty renal epithelium. The complexion became more murky in hue, wearing a light buff colour. The fluid in the pleural cavities increased, and the breathing became interfered with, so that he had always to sit up in bed. By the end of January the urine, now very scanty, contained blood, so that it had the colour of port wine; and he began to complain of pain in the loins, a symptom from which he had not before suffered. From this time he gradually sunk, while the dropsy diminished. He became prostrate, and died without any fresh symptom, February 19.

Post-mortem. The body was generally œdematous, though not to a great extent. The kidneys were of about their natural bulk, their capsules were thickened and adherent, the surfaces covered with granulations. A long irregular depression extended along the outer border of each. On section the cortex was found to be diminished, and its structure coarse. Much fat surrounded the pelvis. With the microscope it was learned that both the convoluted and straight tubes were without their epithelial lining, and were filled with coarse granular material. Detached cells of epithelium were for the most part natural, though some were fatty.

A hardened section showed that there was slight, though generally diffused, increase of fibrous tissue, while there was much irregular obstruction of the tubes.

Both pleural cavities contained old adhesions, and enough fluid to compress the lung to less than a quarter of its proper bulk. The heart weighed 25 oz., the hypertrophy chiefly affecting the left ventricle. The valves were all natural, save a little speck of atheroma upon the mitral; not such as to interfere with its flexibility. There was a good deal of atheroma about the root of the aorta.

The peritoneum contained about 3 pints of clear fluid. There was some irregular thickening of the capsule of the liver. All the other viscera were natural.

Comments. In this case the patient appears to have had renal disease, associated with gout, and evinced by an increase in the quantity of the urine, for a considerable time before his health materially suffered. As is often the case the chronic change appears to have given rise to a degree of tubal inflammation which led to the obstruction of those channels, and consequently to a diminution in the urine, and dropsy. The sudden change in the character of the urine was not accounted for by any circumstance in the history of the case, but it not improbably followed upon some excess in liquor. The man was known to have been a great drunkard. The continual scantiness of the urine was sufficient to show that there was much tubal obstruction. After death it was found that the tubes were blocked up to an extent very unusual with the granular disease. The duration of the œdema (12 months) was sufficient to suggest that it was connected with the more chronic type of disease. There never was any doubt in this case as to the nature of his disorder. The age of the patient, the concurrence of gout, the early increase of the urine and the chronic character of the dropsy, led to an easy and certain conclusion. It was thought worth while to give iodide of potassium, with a vain hope that some such remedy might be found to remove or arrest the intertubular growth. It need not be said that all such views must be abandoned as chimerical. The new growth is a homogeneous addition to the fibrous tissue already existing, and is probably equally out of the reach of removal, by 'sorbifacient,' as by medicines of any other denomination.

CHAPTER X.

TREATMENT OF GRANULAR DEGENERATION.

Essentially incurable, but admits of palliation.

IN the treatment of this disorder it is necessary to have regard to the fact that it is essentially incurable. The kidney has undergone changes from which there is no return. Tubes have been destroyed, and others that remain are interfered with by the presence of fibrous tissue, which is as far beyond the power of medicine to remove as fibrous tissue which belongs to the original structure of the body. We are therefore unable to touch the disease in its organic seat. All we can hope to do is to modify its progress and delay its consequences; and in this way much may be done. Life may be prolonged, in some cases almost indefinitely, while the bodily and mental powers are retained with so little loss that the patient, though a valetudinarian, may be equal to many of the duties and pleasures of life.

General agreement as to treatment.

There is much less diversity of opinion as to the treatment of the chronic forms of Bright's disease than of the acute.

Patient seldom applies until disease advanced.

It is but seldom that a patient comes under treatment until the disease has caused such injury to the gland as is sufficient to disturb the health in some obvious manner. There has been a gradual access of dropsy, there is troublesome dyspepsia or vomiting, the sight has become impaired, some cerebral disturbance has occurred, there is an indefinite failure of health which renders the patient unable to follow his usual avocations, or perhaps some conspicuous change in the urine has arrested his attention.

General principles of treatment.

The irremediable state of the kidneys compels us to direct our attention not to the disease but to its consequences. We may do something to cleanse the system from the contamination of excrementitious matter, and we may meet, with more or less success, the symptoms which arise in the course of the complaint.

Climate.

There is probably no part of our surroundings which has so great an effect on the promotion or arrest of granular degeneration as climate, but it will be better to devote a separate chapter to this important branch of the inquiry, and to consider at present only such measures as do not involve change of habitation.

Skin to be kept active.

If the patient be in a quiescent state, not pressed by any urgent disturbance, much may be done to keep him in comparative health. The secretions, particularly that of the skin, should be kept in an active state. The patient should be completely clothed in flannel, and should take regular exercise such as to produce perspiration. The greatest benefit may be derived from the use, at regular intervals, of a hot air or a Turkish bath. Patients sometimes complain at first that such baths exhaust them, but they generally soon learn to like them for the sake of their obvious benefit.

Vapour baths

They may be given twice a week in an urgent case, once a week if there are no pressing symptoms, while in a patient who has been restored to some degree of health by their action, once a fortnight may suffice. Under their influence the general health improves and the complexion becomes brighter and clearer. The muddy tint of the face may be often seen to be visibly different on the day following the bath. The vapour or hot air bath is of most service in cases where the urine is copious, or at least not scanty; and is more effective as a means of improving the general health than as a cure for dropsy. By the periodic use of this evacuation we prevent the accumulation of the mischievous substances which the kidneys have failed to remove.

Most useful where urine copious.

Iron.

Beside such measures, it will generally be necessary to give iron. The citrate or acetate answers the purpose.

The acetate * may be mixed with liquor ammoniæ acetatis,

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* Dr. Basham advises the mixture of tinct. ferri perchloridi with liquor ammoniæ acetatis and acetic acid. This is an indirect method of giving the acetate of iron, which must result from the decomposition of the salts.

should it be thought well to give acetate of ammonia for the sake of its effect upon the skin, or with acetate of potass if a diuretic be needed. The sulphate or perchloride may be used if the urine contain blood, or there be any other indication for an astringent.

Diet.

As to diet, it is necessary to pursue a judicious and medium course. Nitrogenous or animal food increases the formation of urea, while non-nitrogenous or vegetable food diminishes it. Urea is probably formed from the excess of animal food, as well as from the waste of tissue. A meal of animal food has an immediate effect in increasing this element of the urine, while vegetable food has been shown not to have the same action.*

The food therefore should be as non-nitrogenous as is onsistent with the proper nutrition of the patient. A purely vegetable diet has been tried, and found not to succeed, and the anæmic tendencies of the complaint forbid the use of a non-nutritious regimen. At the same time it is obvious that the patient should be kept upon the smallest amount of animal food upon which he can thrive.

Alcoholic liquors.

It does not appear that harm is done by the moderate use of alcohol; indeed it often has a most beneficial diuretic action. In gouty cases beer should be avoided, while gin or other spirit, in a diluted form, often agrees well. Among wines, claret appears suitable. Dr. Prout advises sherry or hock. In the choice of alcoholic beverages much may be left to the circumstances and peculiarities of the individual.

With such a basis of treatment in quiescent cases, complications must be met as they arise.

Dropsy treated by diuretics.

The dropsy may be treated by diuretics, mixed and varied until an effective remedy is hit. Most uncertain where they are most needed, it is not possible to lay down rules of any general application, as to the selection of these medicines. Perhaps the most effective is scoparium, used as decoction, three or four ounces for a dose. Small doses of digitalis, squills, or juniper, may be given with one or other of the saline diuretics, nitre or acetate, or bitartrate of potass. Nitric ether may take a place in any mixture, and cantharides may be used as a last resource. Dr. Christison,* in speaking of remedies of this character, gives preference to digitalis squills and bitartrate of potass taken together. Dr. Burrows, speaking of the good effect of diuretics in chronic Bright's disease, advises a mixture containing tartrate of potash and nitric ether.† The inhalation of the oil of juniper has been advocated of late, but in a few cases in which I have seen it tried no effect has been observed.

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* See Parkes on the Urine, p. 50.

Purgatives.

Should œdema resist the action of such medicines, purging and diaphoresis must be enforced. Hydragogue purgatives, as jalap or cream of tartar, may be given occasionally or at regular, but not too frequent, intervals. A compound jalap powder may serve twice a week, or a senna draught as often, to which one or two drachms of bitartrate of potass have been added. Elaterium is a resort for emergencies. Vapour baths are better borne in this disease than in any other renal affection, and though too often ineffective, may be used as a means of keeping down œdema. Acupuncture may be necessary in rare cases; it must be used with the precautions already urged.‡ But such measures which have for their object the removal of dropsical effusion are not needed in a large proportion of cases. Many patients die without having had dropsy in any form, and others have it only for a short time.

Vapour baths.

Acupuncture.

Treatment of stomach symptoms.

A careful regulation of the diet is of course necessary, in all cases of dyspepsia, whether associated with albuminuria or with any other condition. In the dyspepsia which belongs to this form of renal disease much may be done by medicine. The remedies which appear most useful are nitric and hydrochloric acids, and strychnia. These may be given with calumba or some other mild bitter. Acids appear to be sometimes indicated by the presence of alkaline or ammoniacal secretion in the stomach. When vomiting becomes frequent it is a very intractable symptom. After mineral acids and strychnia, hydrocyanic acid, creosote, brandy and soda water, and ice, may be used in succession, with more or less relief of a temporary kind. Dr. Johnson advises the use of warm water as an emetic, so as to wash out the abnormal secretion which keeps up the irritability of the stomach.

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* Clinical Lecture, Ranking's Abstract, 1852, p. 85, vol. xv.

† Ranking's Abstract, vol. xxiii.

‡ See p. 89.

Of head symptoms.

Toleration of exhausting treatment.

A state of semi-coma, with or without convulsion, appears to be the natural termination of the disease. Such symptoms are too often an indication that the disease has passed beyond the power of remedies. In some cases, however, the use of vigorous measures will recall the patient to consciousness and give him a new lease of life.

Bleeding.

Purgatives.

With the granular kidney it appears that there is a smaller tendency to anæmia than attends other forms of renal disease. The subjects of the complaint are mostly of middle age, when the tissues cease to make great demands upon the circulating fluid, and there is established a tendency to plethora rather than anæmia. Whether from this or any other cause, depletion is better borne than with other renal affections. A vigorous purge of elaterium, the action of a strong vapour bath, or even a free bloodletting, will sometimes rescue the patient from impending death. Probably the cases in which the last measure should be employed are few. The hardness of the pulse appears to be a trustworthy guide. In most cases the best chance will be afforded by acting vigorously upon the bowels, while the patient is sufficiently kept up by alcoholic stimulants. Half, or a third, of a grain of elaterium, with a little confection of senna as a vehicle, a little croton oil, or any aperient which acts powerfully in small bulk, will answer the purpose.

Intolerance of opium.

It is not seldom that the comatose state to which this disease tends has come on before its time, in consequence of the administration of opium. Intolerance of this drug is one of the peculiarities of the disease; doses so small as to be looked upon as safe under any circumstances will sometimes have a poisonous effect. I may instance a case where a patient became comatose after taking five grains of Dover's powder, a medicine which has been stated, though with no great probability, not to possess the poisonous properties of the opium it contains.

Inflamma-

With regard to the inflammatory and other complications, it is not necessary to follow in detail the methods to be pursued for their relief. Such general rules as may be laid down are chiefly of a negative kind. Opium and mercury must be avoided, while measures of a depressing tendency must be used with caution. With regard to pericarditis, one of the most frequent of the complications of the disease, we are often saved any uncertainty as to treatment by its remaining undiscovered until the post-mortem examination. External applications will of course be used where possible. Bronchitis, one of the most frequent complications of granular degeneration, may be treated much in the ordinary manner. Antimony in small doses, and in conjunction with ammonia, is given with decided advantage in acute cases; in the more chronic, ammonia with senega and squills.

tory complications.

Bronchitis.

Among hæmorrhagic complications apoplexy often occurs, as has been mentioned, in persons who are not recognised as having renal disease, and the treatment will be adopted in ignorance of any such complication. Now that bleeding has become unfashionable, and mercury has lost its repute as a *catholicon*, there appears to be nothing in the ordinary treatment of apoplexy which needs to be modified on account of the co-existence of granular degeneration.

Hæmorrhagic affections.

Apoplexy.

Bleeding from the nose sometimes resists the use of ice and ordinary styptics, and has to be stopped by plugging the nostrils. It is a very intractable form of hæmorrhage. Almost all the cases of epistaxis which are obstinate enough to call for this operation are associated with renal disease.

Epistaxis.

Some of the points of treatment which have been adverted to are exemplified in the following case.

Attacks of Loss of Speech, with subsequent Coma, in a patient suffering from granular degeneration of the kidneys, and gout. Relief from blood-letting, purging, and vapour baths.

Henry Armstrong, fifty-five years of age, a coachman in a gentleman's household, a man who had lived freely and had gout, was brought into St. George's Hospital, August 23, 1866, under the following circumstances. It appeared that the man, who was of a sluggish nature and overfed appearance, lay down after dinner, suffering from some headache and discomfort. He went to sleep, was roused with difficulty, and then was found to be unable to speak. At 11 P.M. he was brought to the hospital, and seen by Mr. Jones, the resident medical officer. He was conscious when admitted, and could walk, but he was unable to speak. In bed he gradually became comatose, with stertor, the pulse at the same time becoming quick and remarkably incompressible. Mr. Jones at once had him bled, and as soon as 10 oz. of blood had flowed consciousness and speech returned. 18 oz. of blood were taken. He was purged with calomel and croton oil, and ice was applied to the head. On the following evening he again became unconscious, and the pulse, which had been softer, resumed its former character. He was again bled, this time 10 oz. of blood being taken; again, while the blood was flowing, consciousness and speech returned. He subsequently had a trifling amount of hemiplegia, affecting the right arm. He was purged by means of a turpentine injection, a draught was given at intervals containing sulphate of magnesia and antimony, and he went on without any recurrence of the symptoms. The urine was pale, copious, highly albuminous, and contained dark granular casts. He remained drowsy, but was conscious, though still speaking with difficulty or not at all. He had next an attack of gout, and when he had been in the hospital a fortnight he had a convulsive seizure with foaming at the mouth. He soon recovered his consciousness, and from this time gradually got better. As regards the subsequent treatment, he was purged when necessary. He took acetate of iron with acetate of potass, and had a vapour bath twice a week, a proceeding which at first he strongly objected to, but the benefit of which was obvious in the increased brightness and clearness of his complexion on each morning following the bath. Under these measures some little œdema which he had had disappeared, and he became able, by October 16, to leave the hospital and resume his duties. He was made an out-patient, and has, since he left the hospital, taken a Turkish bath once a week with great willingness, so assured is he of the good it does him. He now (May 1867) has the appearance of health, is as active as formerly in his occupation, and has no complaint evident to himself. The urine retains its character; it is pale, plentiful, and albuminous.

Though this man is still alive there can be no doubt that he has granular kidneys. His age, the characters of the urine and of the casts, the coincidence of gout, the general absence of dropsy, and the latent nature of the disease, concur to make this a matter of certainty. The indolent habits of the patient, with a tendency probably to eat and drink more than is good for him, appear to have given a more than usually congestive character to the cerebral attacks consequent upon the disease. It is probable, indeed, that a slight amount of extravasation took place in the left hemisphere. At the same time it is clear, from the trifling nature of the subsequent paralysis, and the rapid recovery of the patient from each attack, that the symptoms were mainly due to functional disturbance. The case furnishes an example of the good effects of blood-letting, as well as of the symptoms which may be taken to indicate such a line of practice. When the more urgent symptoms had subsided the advantage of vapour baths was very apparent.

CHAPTER XI.

DEPURATIVE INFILTRATION.

GENERAL PATHOLOGY OF THE DISEASE.

Designation.

THE disease to which this name has been applied has been hitherto described as waxy or lardaceous, from a real or fancied resemblance which certain of the affected organs bear to wax or lard. Latterly it has been designated as amyloid, from a fallacious analogy with starch or cellulose. The term 'depurative' has been adopted as one of practical significance, claiming kin with the suppurative process which will be shown to be the most common cause of the disease.

General, not local.

This affection is not, like nephritis or granular degeneration, limited to one organ. It has its origin in changes which pervade the whole frame, and produce tangible alterations wherever arteries penetrate. Many organs are affected at the same time, or in quick succession, and the kidneys are not exempt from the general influence. The primary change is probably—almost certainly—in the composition of the blood; the next a morbid deposit, which first appears in the walls of the small arteries, and afterwards in the surrounding tissues. The change may affect the liver, spleen, kidneys, supra renal capsules or lymphatic glands; the entire mucous lining of the alimentary canal; the membranes of the brain and cord; morbid growths the result of former disease; or, in short, almost any part of the body to which blood vessels go, or which, even without vessels, is under the influence of the circulation.

Parts attacked.

The change, as it affects the solid parts, consists in the deposition of a new tissue or deposit, which can be distinguished by the action of iodine. The term 'amyloid' has been rashly given, in consequence of a resemblance which, as far as regards this reaction, was thought to exist between the morbid product and starch. Cellulose, however, rather than starch, resembles the 'amyloid' matter in this respect.

New material deposited, which has peculiar reaction with iodine.

The normal tissues take a yellow colour with solutions of iodine; the morbid material a deep reddish brown. The morbid material appears to possess a strong affinity for the reagent; it absorbs it eagerly, holds it tenaciously, and assumes its full colour while the healthy parts take only a faint and superficial tinge. This reaction is represented in plates 8 and 10, and is the most ready and certain mode of recognising the change. A few drops of an iodine solution poured upon a mucous surface or on the section of an organ, give under ordinary circumstances a uniform yellow tinge; if the peculiar deposit is present, it becomes conspicuous by the contrast which its deep brown colour presents to the unaffected parts.*

It has been stated, that with the addition of sulphuric acid a blue tint is obtained, but this appears to be an error of observation, partly arising from the fact that when sulphuric acid acts upon iodide of potassium—a salt generally present in the test solutions used—a precipitation of iodine takes place, which blackens the tissue.

Brown, never blue.

With such certain and ready means of detecting the formation, we are able to discern its first appearance in the walls of minute arteries, and trace its increase until it forms a formidable addition to the bulk of the viscera. First observed as thickening the walls of the smallest arteries, and producing an appearance of exaggeration of their transverse fibres, the new matter, which then is transparent and homogeneous, penetrates their coats and gradually works its way into the surrounding tissue.

Deposit first in blood vessels;

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* A solution for the purpose is readily made by dissolving iodine in water, with the help of iodide of potassium, until a solution of the colour of brown sherry is obtained. Or the same result is reached by diluting the liquor iodi of the Pharmacopœia.

Then outside them, The changes which result are somewhat different in the several organs. In the solid viscera the effused matter remains about the vessels, and fills the interstices of the structure. These organs, the liver especially, often increase greatly in size, and become hard, grey, and semi-transparent, as if they had been intimately and uniformly infiltrated with white wax, an appearance which has given a name to the disease. causing waxy enlargement, The kidneys, supra renal capsules, and lymphatic glands, are all apt to assume the same firmness and waxy translucency. In the spleen the deposit often exaggerates the malpighian corpuscles, until they look like grains of boiled sago. The mucous membranes, which are very liable to the change, especially that of the small intestine, are affected in a different increased secretion, manner. The vessels are altered, as are those in the solid organs, but the exudation, instead of being retained in the tissue, appears to pass off as a secretion from the surface, giving rise to vomiting or diarrhœa, when the stomach or bowels are concerned. Mucous membranes thus affected often have an œdematous look, as if they had been soaked in fluid.

or distinct tumour. Not only does the new deposit modify, as described, existing structures, but it may occur as an independent growth attached as a tumour to some part of the body. This is rare.* Dr. Murchison describes one instance, and I have seen another.† The tumours were of the size of a chestnut or plum; they were connected in each case with the cerebral membranes; they consisted of a translucent firm material, like cartilage to the naked eye, which was homogeneous, except that it had a tendency to a fibro-nucleated structure. The characteristic reaction was present in each case.

The disease, then, essentially consists of a general outpouring of a certain material which differs from the proper constituents of the body. It remains to be seen what this material is, and under what circumstances it is thrown out.

It appears that the material is fibrine, which has been deposited in this form in consequence of the loss of the alkali with which it is ordinarily combined, and which seems to be necessary to hold it in solution.

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* Pathological Transactions, vol. xiii. p. 3.

† Ibid. vol. xiv. p. 261.

Deposit is dealkalized fibrine.

For a detailed account of the reasons which have led to this conclusion, I must refer to a paper just published in the Medico-Chirurgical Transactions.*

Essentially fibrinous.

The results of ultimate analysis show the morbid deposit to agree in composition with fibrine and albumen. That it is fibrine, and not albumen, is shown by the facts that it has a strong tendency to undergo contraction after its deposition; that it becomes converted into fibroid tissue, a metamorphosis which is common with fibrine whenever it is deposited in small bulk, as a coagulum in the arachnoid, or vegetations upon the valves of the heart; and lastly, that, in certain cases it is identical in appearance and reaction, as well as continuous in position, with the hyaline casts which are found in the renal tubes, the fibrinous nature of which it is not possible to doubt.

Wanting in alkali.

The most striking characters of the formation are, however, due to the absence of the free alkali, which is associated with fibrine when in a natural state. This deficiency, which is indicated by the behaviour of the deposit under various circumstances, is proved by analysis, and the results verified by the synthetical production of a material which has the characteristic reactions.

The following table shows the amount of potash and soda contained in a given weight of 8 waxy and 7 healthy livers, that organ having been selected for observation because the new material is more abundant there than elsewhere.

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* On Waxy, Lardaceous, or Amyloid Degeneration. Med. Chir. Trans. vol. l.

Table showing percentage of Alkaline and Earthy Salts in seven Healthy Livers.

Case	Soluble Ash	Insoluble Ash	Potash	Soda	Potash and soda together
Liver of an adult, apparently natural	1·181	·053	·187	·255	·442
" " "	1·11	·173	·23	·189	·419
" " "	1·041	·033	·205	·252	·457
" " "	·995	·016	·214	·192	·406
" " "	·912	·037	·22	·25	·47
" " "	·904	·05	·191	·123	·314
" " "	·893	·041	·215	·164	·379

Average percentages:—Soluble Ash, or total Alkaline Salts, 1·00; Earthy Salts (chiefly Phosphate of Lime), ·057. Potash, ·209; Soda, ·196.

Percentage of Alkaline and Earthy Salts in eight Waxy Livers.

Case	Soluble Ash	Insoluble Ash	Potash	Soda	Potash and soda together
Mary Morgan, deep bed sores. Liver in very early stage	1·075	·062	·203	·177	·38
Robert Nutt, large vomicæ. Liver slightly affected	·96	·098	·256	·154	·410
Sent from Edinburgh. Highly affected. Rather dry when examined	·852	·21	·189	·206	·395
From Consumption Hospital. Highly affected. Large vomicæ	·677	·245	—	—	—
James Barry. Universally infiltrated. Dysentery, Syphilis, &c.	·633	·154	—	—	—
Thomas Theakstone. Decidedly affected. Phthisis, ulceration of bowels	·621	·18	·163	·153	·316
Benjamin Thomas. Intermixed with fatty change. Disease of pelvis. Discharge	·614	·262	·086	·19	·276
John King. Decidedly affected. Suppuration from wrist. Phthisis	·481	·209	·12	·053	·173

Average percentages:—Soluble Ash, or total Alkaline Salts, ·739; Earthy Salts (chiefly Phosphate of Lime), ·177. Potash, ·169; Soda, ·156.

From this it appears that in the waxy organ the alkaline salts are reduced on an average from precisely 1·00 in 100 parts to ·739, a loss of one quarter. This loss is large, considering that the new material exists in addition to the normal structure, to which it bears in most cases but a small proportion.

The diminution appears to affect both the potass and soda. It is such that in well-marked cases the affected structure has a decidedly acid reaction, which it imparts to water or spirit. The natural reaction of the liver, as of most of the organs, is faintly alkaline.

Reaction destroyed by potass and soda.

It is scarcely necessary, however, to resort to analysis to prove the deficiency of free alkali in the deposit under consideration. The characteristic reaction, though remaining after the action of acids, of heat, or of caustic ammonia, is at once destroyed if the tissue be allowed to absorb a small quantity of potass or soda—as, for instance, if a section of the affected organ be soaked for a short time in a dilute solution of either of these alkalies.

Reaction with indigo.

Another indication of the dealkalized state of the waxy matter is afforded by the reaction of indigo. This additional proof is not necessary, since the fact must be beyond question; but I am tempted to describe it in consequence of the beauty of the results. Free alkali destroys the colour of sulphate of indigo. If a microscopic section of an organ affected as described be treated with this pigment, the alkali in the natural structures will destroy the blue colour, so that they will in time fade to a light green, or yellow; the amyloid matter, however, will retain for an indefinite period the deep blue of the indigo, and will show in bright and striking contrast with the dull tint of the neighbouring parts. I may refer to some plates in the paper already mentioned as examples of this effect.

Artificial production of 'amyloid' matter.

Lastly, the 'amyloid,' or waxy matter, or a material which is identical with it in all its reactions, can be made artificially by depriving fibrine of its alkali. This can be done by dissolving fibrine in dilute hydrochloric acid (6 parts of acid to 10,000 of water), the only acid in which it is soluble. The fibrine can be recovered in a dealkalized state, by evaporating the solution. A translucent gelatinous material is obtained, which shows the 'amyloid' reactions in the most striking manner. The contrast between the colour produced by iodine upon ordinary fibrine, and upon fibrine treated as described, is the most graphic illustration of the difference between 'amyloid' and healthy tissue.

It is worth remarking that while the alkalies are wanting in the morbid deposit, the earthy salts, as if to make up for the deficiency, exist in larger quantity than in health.

The material then which is poured out under certain conditions, and which has been styled waxy, amyloid, or depurative, is dealkalized fibrine.

Causes of the disease.

As far as we can trace the conditions which lead to the separation of this material from the blood, we have a loss of alkali associated with a loss of albumen. The alkali is probably discharged at the expense of the fibrine, which therefore becomes apt to be deposited, while the removal of the albumen of the blood gives the fibrine a relative superabundance.

There appear to be several modes by which the essential materials are removed from the circulation. Some are within our observation, and can be recognised as progenitors of the organic change with a certainty of which there are not many examples in the obscure heraldry of disease. Morbid changes in the darkness which involves their origin are like the men they afflict; it is only in exceptional cases that we can trace their descent.

Suppuration the common cause.

By far the most frequent cause of the disorder is protracted suppuration. The discharge must be copious and long-continued; it is not necessarily connected with tubercle or with any other constitutional taint, or with disease of bone.

The accompanying table, compiled from cases which have come under the notice of the author, shows that of 66 cases, 51 were known to have been associated with a profuse and long-continued drain of pus; while in 5, suppuration, though not under observation, was concluded, from the post-mortem appearances or other circumstances, to have gone on at some antecedent period. Thus about five-sixths of the cases which fell indiscriminately under notice were associated with this process.

Table showing the Affections antecedent to Waxy Infiltration in 66 Cases under the observation of the Author.[*]

51 Cases in which there had been protracted Suppuration.

From caries, or necrosis, with exposure of bone	20
„ disease of spine with psoas abscess	1
„ profuse suppuration, consequent upon amputation of thigh	1
„ „ „ „ compound fracture of leg	1
„ phthisis with vomicæ	11
„ dilated bronchi	1
„ destruction of kidney by tubercular excavation (1 case with psoas abscess)	2
„ ulcerated cancer	5
„ dysentery with abscess of liver	3
„ ulceration of bowels, not dysenteric	3
„ deep and long-continued bed sores	1
„ severe syphilitic ulceration of throat or penis	2
	51

5 Cases in which there was presumptive evidence that Suppuration had formerly gone on.

From disease of elbow-joint, for which arm had been amputated	1
„ extensive disease of spine, with much curvature and loss of bone	1
„ phthisis, with extensive cicatrices	2
„ history of dysentery in India, also syphilis	1
	5

4 Cases in which there had been Albuminuria associated with some other form of kidney disease.

From tubal nephritis (much dropsy, urine scanty, highly albuminous)	4

6 Cases in which the cause could not be traced.

(In one the patient had been long in India, but was not known to have had dysentery.)

Associated with the stated lesions, tubercular deposit was found in 27 cases; cancer in 5; syphilis in 6. There were 30 in which there was no evidence of either of these diseases.

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[*] This table includes all the cases which have come under the notice of the Author, in which a post-mortem examination was made; no selection has been made. 8 of the cases were under the age of sixteen, the rest adults. The greater number occurred in St. George's Hospital.

The association between protracted suppuration and the *depurative* deposit is such, that wherever the former exists the latter may be expected. In a considerable proportion of cases where the discharge is profuse or long continued, the peculiar infiltration is sufficiently abundant to produce obvious symptoms. There are few such cases in which traces of the change cannot be found on post-mortem examination.

Its mode of action.

In this undoubted relationship of cause and effect, it is easy to trace the bond of connection.

Removes alkali and albumen.

The discharge removes the alkalies from the system, while at the same time it causes a relative increase in the amount of fibrine.

Pus is an albuminous fluid which is rich in alkaline matter. For details on this head I may refer to the paper already mentioned. Speaking roughly, pus contains about one per cent. of alkaline and earthy salts, the alkaline existing in about ten times the quantity of the earthy part. The strongly alkaline reaction of the discharge when fresh is evidence of the disproportionate quantity of alkali which there finds exit. The loss of alkali is associated with a loss of albumen, which must reduce the amount of that substance in the blood and increase the proportion which the fibrinous bears to the albuminous part of the serum. With the fibrine relatively increased, and the alkalies positively deficient, the dealkalized fibrine is deposited in the smallest arteries. There the force of the circulation has been diminished by distance, and broken by subdivision, and the current has been sufficiently retarded to allow of coagulation or deposition. The fact that the deposit takes place in the arteries and not in the veins, may perhaps be accounted for by the known deficiency of fibrine in venous as compared with arterial blood.

Consequent deposit of dealkalized fibrine in smallest arteries.

Similar effect from albuminuria.

The next circumstance to which the disorder can be clearly traced is albuminuria, especially of the kind associated with nephritis. It is easy to be seen in such cases, that the albuminuria is the cause, and not the consequence, of the waxy infiltration, for the kidneys are generally in a marked condition of disease, with characteristic history, while the depurative change is very slightly developed. Of the 66 cases, there were 4 in which the disease appeared to be due to this cause. A long continuance of highly albuminous urine must have an effect analogous to that of a discharge of pus. The albumen appears to carry alkali with it, for as a general rule albuminous urine, particularly in cases of long standing, is wanting in acidity.

Some cases unexplained.

Of the 66 cases there remain 6 in which there was no evidence of any morbid discharge. Looking somewhat minutely into the circumstances of these 6 cases, it appears that 3 of the subjects had been great drunkards. One, a girl of twenty-four, had been a prostitute, but there was no other reason to suspect syphilis. As to the 2 remaining cases, there was nothing, as far as our knowledge went, that could be assigned as a cause of the change. One related to a girl of fourteen, who died of bronchitis; the other to a woman of thirty-two, whose death was chiefly due to diarrhœa, consequent upon the extension of the change to the bowels.

With regard to these apparently exceptional cases, it must be allowed that a flow of pus may exist for a time, give rise to the disorder which will ultimately prove fatal, and cease, leaving behind it no such obvious traces as will suffice for a record of its existence. This is particularly the case when the suppurative process affects the alimentary canal. Yet though suppuration must necessarily, from this and other circumstances, occasionally escape notice when it has been a potential source of disease, we cannot assert that the change has no origin but in such a discharge.

Same state possibly due to other circumstances.

We cannot as yet presume to be acquainted with every process by which the blood is so altered as to contain excess of fibrine with deficiency of alkali. We may surmise that there are conditions, less capable of demonstration, by which this alteration is produced. Many circumstances impair the nutrition of the body and alter the composition of the blood. We know that in some disorders the fibrine is increased; we may conjecture that the proportion of alkali is likewise subject to morbid variation. It may be eventually shown that there are diseases which act upon the blood so as to produce the effect of a purulent discharge, and occasion the depurative deposit without the medium of suppuration. That such causes are relatively uncommon is evident from the facts which have been brought forward.

Drunkenness.

It will be observed that in 3 of the 6 cases in which the origin of the disease was left in doubt, the subjects were intemperate spirit drinkers.

Climate.

Judging from the cases admitted into St. George's, it would appear that the disorder is especially frequent among persons who have been exposed to the climate of India. Whether this is merely due to the prevalence of dysentery, or whether the climate, in the malnutrition which it engenders, produces a liability to the disease which does not exist elsewhere, further experience must show.

Syphilis.

There is a general belief among pathologists, that syphilis has a direct power of causing the deposition. I can find no proof that it is so. Syphilis is a prolific source of ulceration and disease of bone; in all the cases under my own notice, where it has been associated with the organic change, there was a suppurative drain of an unmistakeable sort, save in one instance, in which the only reference to such a discharge was an attack of dysentery in India, which had left no certain traces behind it (see case of Barry, p. 209).

Congenital syphilis, although often fatal, does not appear to be associated with the peculiar change; probably because it is not attended with any suppurative lesions.

As to other diseases which are productive of 'cachexia'—a vague term which has been much used in describing the antecedents of waxy deposition—there is no reason to believe that either tubercle or cancer has any direct power of causing the disease in question.

Tubercle and cancer not direct causes.

From the fact that of all causes of protracted suppuration tubercular deposit is by far the most frequent, it follows that tubercle coexists with a large proportion of cases of depurative infiltration. And cancer coexists with a small proportion, inasmuch as it is a more infrequent source of discharge.

Among the 66 cases recorded in the table, there was evidence of syphilis in 6; tubercular deposit was present in 27;

cancer in 5. In 30 of the number there was no trace of either syphilis, tubercle, or malignant disease.*

KIDNEYS DESCRIBED IN DETAIL.

To this sketch of the general pathology of the depurative disease it will be necessary to add some particulars regarding the kidneys.

A favourite seat of the disease.

These organs are exceedingly favourite seats for the deposit. The malpighian tuft, in its arterial character and its minute subdivision, possesses in the greatest degree the facilities for the peculiar deposition. The kidneys are often attacked first; and even when this is not the case, they usually become so early involved in the disease that the change in their secretion is one of the first symptoms.

Naked eye appearances.

The following changes are produced in their appearance and structure.

Earliest changes.

Examined at the earliest date at which the change can be recognised, the kidney is slightly pale and anæmic. If altered in consistence, it is firmer than before. The organ would pass for natural, but that the iodine solution dots the malpighian bodies. The surface is smooth, rather pale perhaps, the cortex in due proportion, and every other character that of health. As the disease goes on, an increase of size takes place, and the capsule becomes adherent. At this

Anæmia.

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* In the preceding account of the waxy or depurative infiltration I have rather endeavoured to show what it is than what it is not. In the face of the direct evidence which has been brought forward it has not been thought necessary to discuss the starch theory at any length. It may be as well to allude to an opinion, originally promulgated by Meckel, that the deposit consists essentially of cholesterine. This substance is not nitrogenous, as the amyloid deposit is known to be. It does not give the characteristic reaction with iodine. It has, as far as I am aware, only been found in the liver as connected with this change; in which organ cholesterine occurs in many forms of disease. This substance probably is rather an occasional and accidental associate of the waxy deposition than essential to it. The waxy change is continually associated with fatty degeneration, and in the liver cholesterine—which is allied to fat—is sometimes present. For an interesting account of the opinions which have prevailed regarding this disease I may refer to a paper by Dr. Pavy 'On the so-called Amyloid Degeneration,' in the Guy's Hospital Reports 1864.

Plate 8

DEPURATIVE KIDNEY SHEWING REACTION OF IODINE.

M & N Hanhart Chromo lith.

(See Description of Plates

off, which is not done without difficulty, the surface has a sandy texture. The regular covering of uniform small granulations, such as follows from granular degeneration, does not occur as a consequence of the depurative change.

On making a section of a kidney in which this process of shrinking has advanced, it is seen that the cortex is diminished, particularly its superficial parts, sometimes the cones being within the thickness of a shilling of the capsule. Whether shrunk or not, it is generally to be seen with the naked eye, that the cortex contains numbers of shining dots like specks of glass, which are malpighian bodies enlarged and altered by the disease. Cysts, true to their character of belonging to intertubular diseases of the kidney, are common in this disorder. They usually are of very small size.

Malpighian bodies.

Cysts.

The great test, however, for the existence of this form of disease is iodine. This holds good in all its stages. Early in the disease the iodine solution simply dots the malpighian bodies, staining them more deeply than the intervening tissues. Sometimes these structures stand out in a conspicuous manner, so as to look like grains of brown sand sprinkled on the section. Later in the disease brown lines become visible on the cones, which are straight vessels affected by the disease. Finally, in cases of long standing, almost the whole of the substance exposed by section, as well as the surface of the organ, gives the characteristic colour.

Action of iodine.

The deep brown shade—like that of polished walnut wood —of the affected parts, affords a striking contrast with the light yellow colour of the portions which have escaped (see plates 8 and 10).

MINUTE ANATOMY OF THE DEPURATIVE INFILTRATION OF THE KIDNEY.

As regards minute and essential changes, there are three steps in the disablement of the kidney by this disease.

First, an alteration in the walls of the blood vessels. Secondly, an effusion through them into the tissue and cavities of the gland. Thirdly, consequent changes in the tubes, which cause them to become plugged up.

Blood vessels of malpighian body.

In tracing the mechanism of these successive changes, the blood vessels must be first considered. These are affected while yet every other part of the organ is natural, and before there is any symptom of renal disease. The first change is observed in the knot which forms the malpighian body which becomes somewhat enlarged, and displays the characteristic colours with iodine and indigo. The enlargement is due to a thickening of the vessel, which often gives a nodular outline to the tuft. The size of the tuft increases as the disease progresses, while the capacity of the vessel is diminished. A deposit of fat upon the exterior often helps to produce the sparkling appearance which the malpighian bodies acquire in this disease.

Vessels of cones.

After the malpighian body has become altered as described, the same change proceeds to the vessels which enter and leave the capsule. The larger arteries escape, as also do the capillaries and veins. The alteration is often conspicuous in those straight arterial vessels, which, after leaving the malpighian corpuscle, pass through the cones, and have received the name of arteriolæ rectæ. These, as they lie in numbers among the straight tubes, are often distinguished with difficulty from them. They are of about the same diameter, and but for the detection of transverse fibres in their walls, would be apt to be regarded as urinary tubules. In many of the affected vessels the transverse fibres of the muscular coat are unnaturally distinct, as if they had undergone a sort of hypertrophy. The walls are thickened, and the calibre narrowed. Besides these alterations, the affected vessels are readily detected by the peculiar colour given by iodine, and by their retaining the deep blue of indigo.

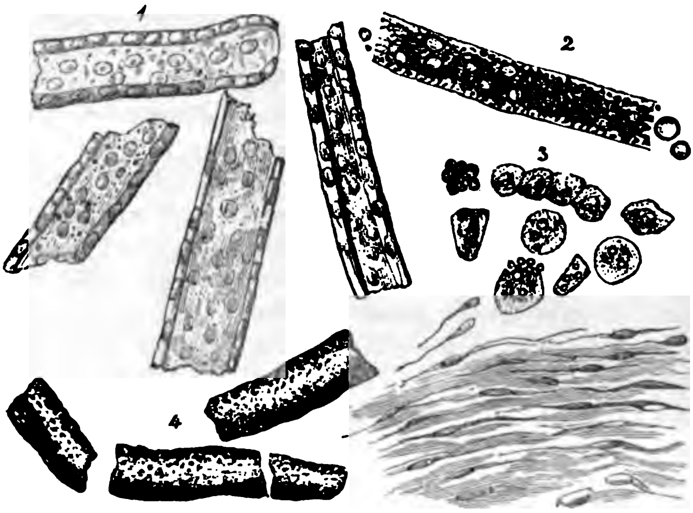
The appearances produced by iodine are shown in plate 10. For those given by indigo, I must refer to the Medico-Chirurgical Transactions for 1867.

By the time the change has extended to the straight vessels, or often while it is apparently limited to the malpighian

Changes in tubes.

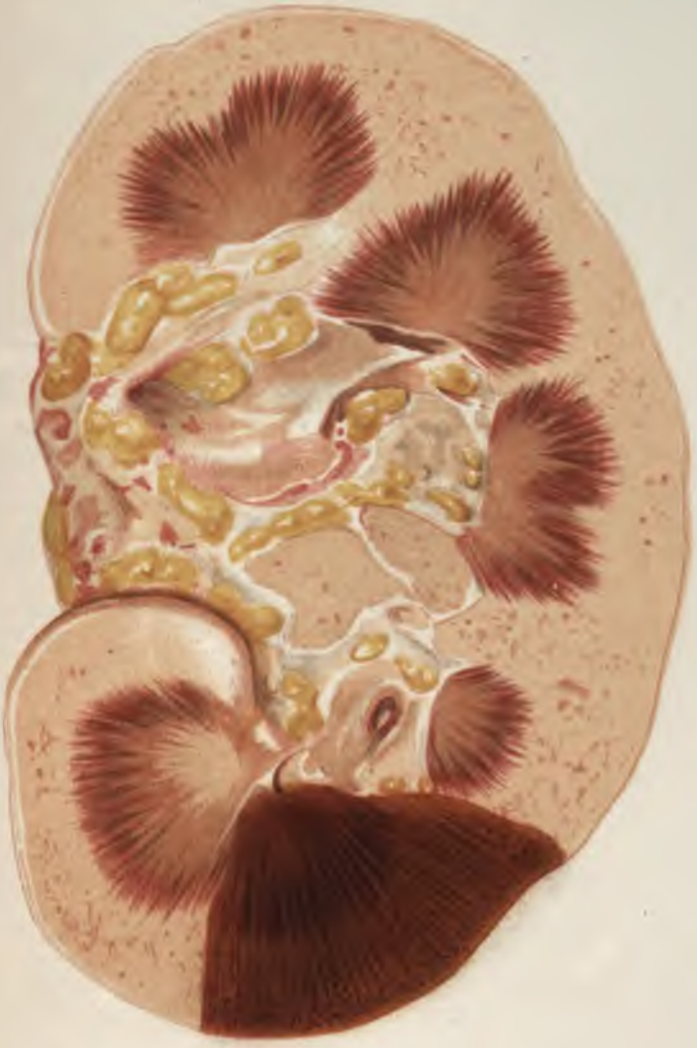
At first stiffly open.

the kidney of Roberts, plate 9.) Beside this exudation into the cavities, the condition of the tubes requires notice. In the earlier stages of the disease the cortical tubes are, if such an expression be allowed, morbidly healthy. Their normal structure is displayed with abnormal distinctness. The epithelial cells hold to the wall with more than proper constancy, and the cavity continues open and distinct long after death. Kidneys in this state of disease are admirably adapted for demonstration; they realise quite the physiological ideal. It appears that their peculiar character is due to a fibrinous exudation, which at the early stage transudes in minute quantity through the basement membrane, and glues the epithelial cells to each other, and to the tube. The appearance is often such as might result if the epithelial cells had been partially fused upon the wall, which at the same time becomes thickened, probably from some of the exudation becoming incorporated



Waxy Kidney. 1. Tubes rigidly open. 2. Tubes containing fibrine and oil-globules. 3. Epithelial cells; some fatty, others morbidly adherent to each other. 4. Fibrinous plugs which have come out of some of the tubes. Some new fibroid tissue is also shown.

Plate 8



DEPURATIVE KIDNEY SHEWING REACTION OF IODINE.

M & N Hanhart Chromo lith

(See Description of Plates.)

Plate 3

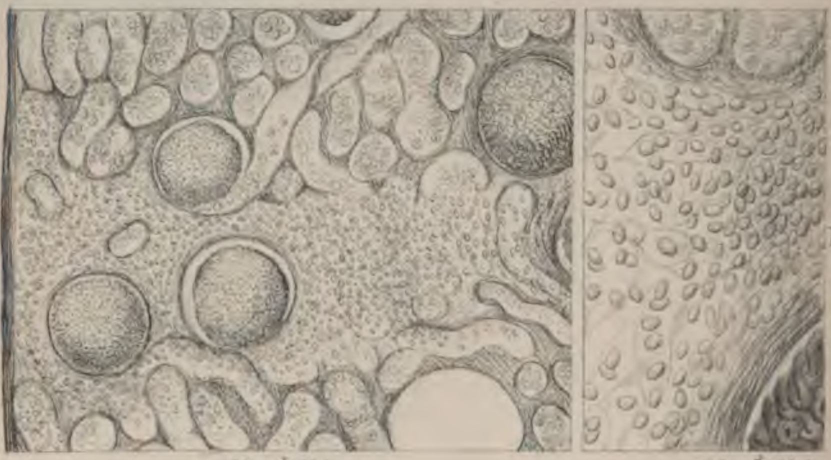


Fig.1

Magn^d 75 d. Magn^d 400 d.

Waxy kidney, showing intertubular growth.

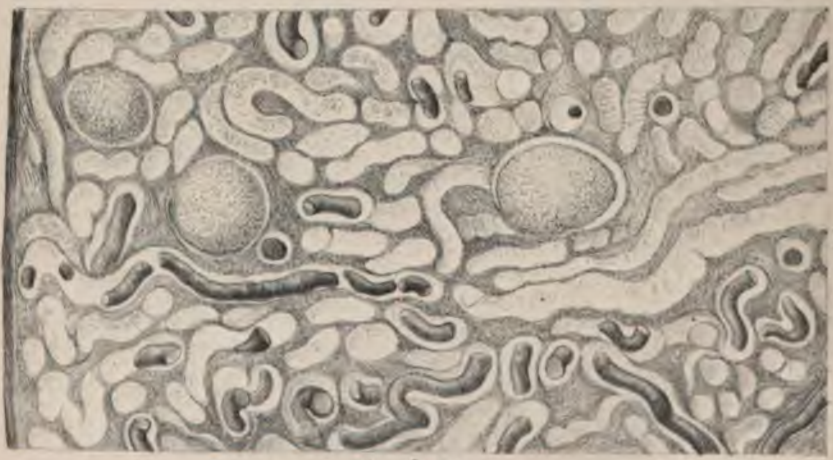


Fig.2

Magn^d 75 d.

Tuffen West del. & sc.

W West imp.

Waxy kidney, showing fibrinous casts,
in tubes

See description of Plates.

bodies, an effusion of fibrinous matter has taken place in the intertubular tissues of the organ, especially near the surface, seldom equally diffused, but poured out in greater bulk at those points where the course of an artery has determined the position of a family of malpighian bodies. Around these a broad formation of new tissue is often seen. This, under a low power of the microscope, has a finely granular appearance (see plate 9). Under the $\frac{1}{8}$th of an inch object glass the new tissue has a closely nucleated structure, like that presented by new fibrous tissue, or some varieties of fibro-nucleated tumours. This growth may be often traced inwards from the capsule, where it is most abundant, along the course of the vessels towards the interior of the gland. It imbeds the tubes which lie in its way, and by its contraction reduces them to solid threads, or cuts them up into minute cysts. In a transparent section, vestiges of tube-structure may be very clearly seen imbedded in the new material. If these intertubular deposits are of any extent, their contractile tendency is generally evinced by an aggregation of the malpighian bodies within them. The distribution of the new growth upon the surface of the kidney is made evident to the naked eye by a loss of level. The situation of each deposit is marked, as has been explained, by a depression, often shallow, smooth, of considerable size, and pinkish in colour.

New matter about vessels, &c.

Becomes fibroid and contracts, compressing tubes, and depressing surface.

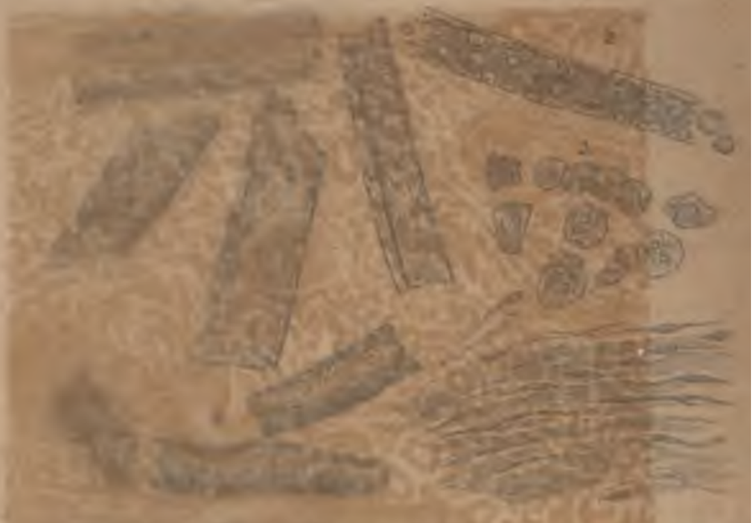
The prevalence throughout the organ of a similar exudation is shown by a general growth of fibrous tissue around the malpighian bodies and larger vessels, and between the cortical tubes, so that if the organ be examined in a fresh state, abundant fibre cells, and loose new fibrous tissue can be found.

Similar exudation forms casts.

Not only does the fibrinous exudation infiltrate the tissue of the gland, but the same material is poured out more or less abundantly by the exposed vessels of the malpighian tuft, and appears in the tubes and in the urine in the form of fibrinous casts. This material, like the exudation in the substance of the organ, occasionally presents the same reaction as the affected vessels, but more often does not. (The appearance of the exudation in the tubes is represented in the kidney of Roberts, plate 9.) Beside this exudation into the cavities, the condition of the tubes requires notice. In the earlier stages of the disease the cortical tubes are, if such an expression be allowed, morbidly healthy. Their normal structure is displayed with abnormal distinctness. The epithelial cells hold to the wall with more than proper constancy, and the cavity continues open and distinct long after death. Kidneys in this state of disease are admirably adapted for demonstration; they realise quite the

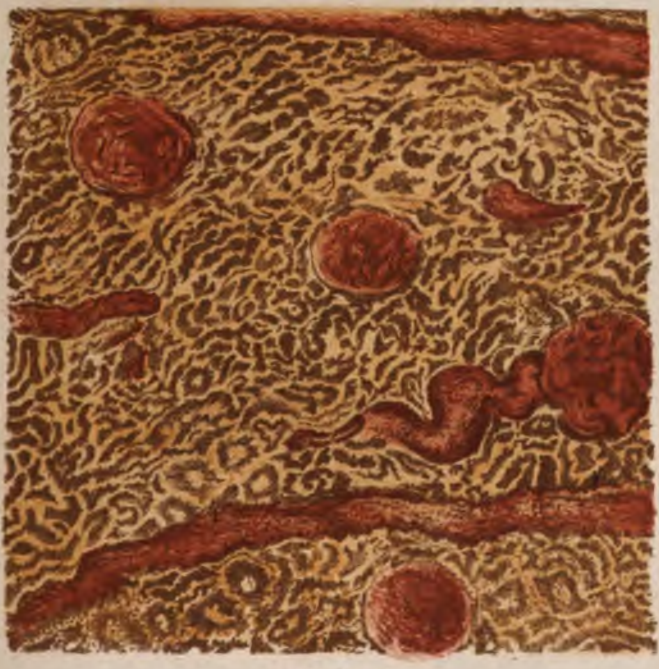
Changes in tubes.

At first stiffly open.



[illegible] 1. [illegible] 2. Tubes containing fibrine and [illegible] 3. [illegible] some free, others partially adhered to each other. 4. Fibrinous [illegible] of some of the tubes. Some fibroid tissue is also shown.

physiological ideal. It appears that their peculiar character is due to a fibrinous exudation, which at the early stage transudes in minute quantity through the basement membrane, and glues the epithelial cells to each other, and to the tube. The appearance is often such as might result if the epithelial cells had been partially fused upon the wall, which at the same time becomes thickened, probably from some of the exudation becoming incorporated



Magn.^{d} 75 d.

Tuffen West del & lith.

W.West Chromolith^{r}

Section of Waxy Kidney showing action of Iodine

See description of Plates.

with it. The fixed openness of the tubes is one of the most marked characters of the disease, and one which has its bearing upon the symptoms. Fibrinous casts are abundantly formed and displaced, and yet the epithelial lining of the tube undergoes no disturbance (Roberts, plate 9). Often, however, when the disorder is drawing to an end, supposing that the patient dies of the renal mischief rather than of any antecedent or associated disease, a catarrhal state of the tubes is set up, and they become obstructed, as in cases of tubal nephritis.

Then obstructed by catarrh.

I ascertained the condition of the cortical tubes in 32 cases of the disease—some fatal from the kidney symptoms, some from other causes. I found that there were 18 in which the tubes were as described, rigidly open, though often containing fibrinous cylinders. In 14 the tubes were plugged with natural or fatty epithelium.

In connection with the state of the tubes it must not be forgotten that the disorder in question may be produced as the sequel of nephritis, in which case the obstructed state of the tubes belonging to the original disease continues. This appeared to have happened in 3 of the 14 cases just mentioned.

Cysts from transformation of tubes and dilatation of malpighian bodies.

It is usual in this disease to find, not only that tubes are fixedly open, as has been described, but that they are often distended by fibrinous plugs. They also are often irregularly dilated and constricted, owing to the contractile influence of the tissue around them. When the new growth exists in any bulk, the tubes imbedded in it are often distinctly cut up into minute cysts. Beside cysts, formed in this way out of tubes, a similar result is sometimes produced by a dilatation of the capsules of the malpighian bodies in the same way as has been described with granular degeneration. Cysts arise, whether the kidneys be granular or waxy, from the constricting action of new growth external to the tubes. With granular degeneration the new formation, though in smaller bulk, has a more powerful contractile tendency, and is therefore a more fertile source of cystic transformation than in the disorder under consideration.

Changes in epithelium.

As an associate of the 'amyloid' change, it is common to find fatty degeneration. The fatty change often precedes the other. After much discharge from vomicæ or elsewhere, it may be predicted, without much chance of error, that the liver will be either waxy or fatty. In most cases both conditions will be present. With the waxy kidney oil is often deposited in the epithelium. In 33 kidneys so diseased, I found that the epithelium contained oil in 19; in 9 of which the cells were loaded, while 10 were only slightly affected.

Beside the alteration in the epithelium, it occasionally happens that, as in granular degeneration, some of the cells become angular and distorted in shape, cramped by the narrowing circumstances of the tube in which they lie.

Alteration of arteries primary change.

The peculiar alteration of the smaller arteries, lying as it seems to do at the root of the disease, affords a simple explanation of the subsequent changes. These little vessels are so modified as to become penetrable in a morbid degree to the liquid part of the blood which they contain. They retain the corpuscles, but the liquor sanguinis holding albumen and fibrine in solution, passes through them, both into the interstices of the gland and from the free malpighian vessels into the tubes. As regards the intertubular vessels, the fibrinous part of their exudation, from its property of solidification and conversion into fibroid tissue, proceeds to incorporate itself with the organ by adding itself to the fibrous structures, and collecting in the most available spaces. The albuminous part, which has no such power of ready organisation, is probably absorbed and removed. A similar process takes place with regard to the vessels which hang loose in the malpighian bodies. The fibrinous part of their exudation becomes consolidated in the tubes, from which it is dislodged in the form of casts. The albuminous portion passes off into the urine without hindrance, and gives its character to the secretion.

Relation of morbid anatomy to symptoms.

With this sketch of the mechanism of the depurative change as it affects the kidney, it will be easy to see how some of the symptoms arise. The deterioration in the blood vessels, which is the first step, though it thickens the walls, makes them leaky, or more than naturally permeable to the fluid they contain. Hence an unnatural outpouring from the malpighian vessels, and an increase of urine, which at the same time is mixed with serum. The tubes remain freely open, and for a long time nothing hinders the passage of serous or aqueous fluid from the malpighian bodies. The fibrinous part of the exudation which passes from them forms the casts which are so abundant. Partly by the plugging thus occasioned, and partly in consequence of a certain amount of tubal inflammation which is apt to come on towards the end of the disease, the tubes become obstructed, and the hitherto copious urine becomes scanty, exemplifying a rule which holds good with every form of renal disease, that the diminution of the urine is in direct proportion to the obstruction in the tubes.

CHAPTER XII.

DEPURATIVE DISEASE OF THE KIDNEY—SYMPTOMS AND TREATMENT.

CLINICAL HISTORY AND SYMPTOMS.

The disease affects both sexes and all ages.

Sex. It is rather more common in males than females, possibly because the former are more exposed to many of the incidents which give rise to it, such as accidental injuries and the effects of tropical climate. Of 61 cases, 36 occurred in males, 25 in females.

Age. No age, except the earliest, is exempt from its attacks. Under my own observation it has proved fatal at the age of 5 years, and at every period of life afterwards, up to 70. It is most frequent between 20 and 30, corresponding in this respect with phthisis, with which so many of the cases are associated.

The following case, which is not included in the foregoing statement, as the kidneys were unaffected, shows the earliest age at which, within my own experience, the disease has been detected in any organ.

Abscess connected with diseased hip. Depurative affection of spleen in a child two years and a half old.

My friend and colleague Dr. Gee called my attention to a spleen which was enlarged, full of translucent bodies like grains of boiled sago, and which with iodine gave the 'amyloid' reaction in the most characteristic manner. It had been obtained from the body of a boy two and a half years of age, who had been under treatment in the Children's Hospital for the last two months with a large abscess in the thigh, which had discharged most profusely. The cause of death was pyæmia. The abscess subsequently proved to have been connected with disease of the hip joint. No iodine reaction appeared except upon the spleen. Although the disease rarely comes under notice very early in life, there appears no reason why it should not occur at any age where suppuration is possible.

The following table represents the distribution of 61 cases among the several decades of life. It will be seen that this disease includes almost the whole period of human life, while nephritis and granular degeneration each pertain to one extremity.

The greatest mortality of the depurative disease is later than that of nephritis, earlier than that of granular degeneration.

Table showing Ages at time of death in 61 cases of Depurative Disease under the observation of the Author. All attested by post-mortem examination.[*]

Age	No. of Cases
From 0 to 10	3
„ 11 „ 20	11
„ 21 „ 30	21
„ 31 „ 40	10
„ 41 „ 50	10
„ 51 „ 60	3
„ 61 „ 70	3
Over 70	0

36 male, 25 female.

Easy of diagnosis. The disorder is easy to recognise during life, perhaps more so than either of the other forms of renal disease. It may be often detected at first sight by the worn and cachectic look of the patient. There are several circumstances which, when they exist together, place the nature of the complaint beyond doubt. The disease generally follows upon a purulent discharge. The urine is albuminous; it often exceeds the natural amount, notwithstanding that œdema may be present. Frequently there is diarrhœa. The liver is apt to become enlarged. Such are the more salient points by which

Salient points.

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[*] Cases in which the disorder appeared to be consequent upon another form of renal disease are not included.

the complaint may be recognised. But it is not necessary that each of these symptoms should be present. The nature of the disease may be clear, although the urine be scanty, the action of the bowels natural, or the liver remain out of the reach of the fingers. As far as I am aware, the persistence of dropsy while the urine is increased is peculiar to this disorder.

Antecedents sometimes a guide.

It may happen that the subject of the renal change is under surgical treatment for disease of bone or joint, and the opinion of the physician is sought, because something in the progress of the case has raised a doubt as to the capability of the patient to recover from a contemplated operation. In such a case the obvious nature of the antecedents renders the diagnosis almost a matter of course. The same may be said when œdema and albuminuria come on in the course of phthisis.

Frequently it happens that the patient is brought under notice solely on account of dropsy, and it is only on careful enquiry that the nature of the preceding disorder becomes evident. It is often found that there is a considerable interval between the cessation of the purulent discharge, with recovery from the original local disease, and the appearance of renal symptoms. Sometimes scars upon the person, or distortions of the spine, will point to the source of the complaint. We may be guided to it by the peculiarity of voice which results from loss of the soft palate, the effect of syphilitic ulceration at some former date. Sometimes a limb conspicuous by its absence will tell a tale of protracted suppuration. Perhaps the source of the disorder has left no external mark. It may have been an attack of dysentery, almost forgotten during the various ills of a tropical life; or ulceration of the bowels, tubercular or of some other sort, which no longer exists. In one case which came under my knowledge the disease was apparently due to the suppuration which attended the healing of a compound fracture. In some cases it comes as the consequence of albuminuria, which has arisen in connection with some other disease of the kidneys; but such cases are rare, and are of

Sometimes obscure.

little practical importance. The depurative disorder in such cases seldom passes beyond its earlier stages, and does not appear to alter in any material degree the symptoms of the previously existing renal disease.

When by such causes as have been assigned, or by others which are less evident, the tendency to the morbid deposition is established, the various organs are affected in an order which is not always constant.

Order in which organs attacked.

The first change is generally to be detected either in the kidneys or the liver; in the kidneys more often than in the liver. Whichever of these structures is first affected, it is usual for the other to follow at no distant time. The spleen, the small intestine, the stomach, and the large intestine, participate in the disease in something like the order in which they are mentioned. The symptoms which arise are due in chief to the kidneys and the mucous membranes.

Change at first latent.

It appears that the deposit which is the essence of the disease may take place to a considerable extent before any symptoms are produced. This is continually seen in post-mortem examinations of patients who have died of surgical diseases. A small amount of recent deposition, lying as it does within the wall of the malpighian artery, does no harm. It is not until the wall of the vessel has been so damaged as to allow the liquor sanguinis to come through it unaltered, that the urine becomes albuminous and the system suffers. The same may be said of the vessels in the mucous membranes. Morbid exudation into the stomach and bowels, as evinced by diarrhœa and vomiting, do not occur until long after the change in the vessels has been such that were the patient to die the iodine reaction would appear. It must be borne in mind that, in the kidney especially, the contractile tendency of the effused fibrine is a source of injury to the gland, which increases with time. It is owing, probably, to this that the symptoms of renal disease are apt to become apparent long after the discharge has ceased.

Symptoms perhaps absent until after discharge has ceased.

Change in vessels rapidly produced.

In order that the deposition should be produced in the vessels, it does not appear that a long time is necessary. In one case the reaction was evident upon the malpighian bodies of the kidney when a discharge had only existed for twenty-one days. The patient, a vigorous young man, had had his thigh amputated in consequence of an accident. Most profuse suppuration took place from the stump, and he died on the twenty-first day after the operation. The kidneys were the only organs affected. A much longer time than three weeks is required before such changes can be produced as to make themselves manifest during life. It often happens, as already stated, that the disease does not attract attention until a long time, even years, after the local drain has ceased, or the conditions, whatever they may be, which have given rise to the disease have been reckoned among the past.

Symptoms mostly due to kidneys and mucous membranes.

When the disease has caused a certain amount of alteration in the kidney, the health becomes affected. It is upon the progress of the disease in this organ and in the mucous membranes that the symptoms mainly depend. The enlargement of the liver and spleen may be palpable, and yet the health may remain without conspicuous change. As soon, however, as the alteration has progressed far enough in the kidney to render the urine decidedly albuminous, the health becomes precarious. The fibrinous material which is effused throughout the kidney becomes organised, as has been explained, in a manner which renders it impossible that the gland so affected should ever be restored to its former condition. If, however, the primary source of mischief ceases before the organ has been extensively damaged, it is not easy to say how far it may become restored to its proper mode of action. The disease, always chronic, is more especially so when it is found as the consequence of a discharge which has ceased. The course of the disorder must usually be counted by years, if we reckon its commencement from the complaint which gave it birth. It is not unusual, however, for it to remain latent until within a few weeks or months of death.

Always chronic,

though symptoms may be of short duration.

If we reckon its duration from the appearance of œdema, or from the symptom which first draws attention to the kidney, we shall find that, though it sometimes passes through many fluctuations of better and worse, and occasionally drags on through many intervals, during which active symptoms are absent, yet that in more than half the cases a few months will lead it to a fatal termination. This disease is probably more variable in its rate of progress than either of the other forms of renal disease; sometimes, as far as symptoms are concerned, as rapid as tubal nephritis; sometimes in its slowness approaching the character of granular degeneration.

Progress variable.

Usually the first symptom of the disease is an increase in the quantity of the urine, with a consequent necessity for nocturnal micturition. This is accompanied by thirst. Œdema then makes its appearance, not with a sudden outbreak, as is the case with nephritis, but with a gradual access. The ankles are observed to be swollen in the evening. This symptom continually occurs, though the urine continues to exceed its normal amount; a circumstance which, as far as I am aware, is not the case with any other form of renal disease. The swelling, seldom excessive, is apt to invade the peritoneum. The pleura and pericardium generally escape; if they become charged with fluid, it is usually not dropsical, but the result of inflammation. At the same time the aspect of the patient is cachectic. He often has the look of one who has been broken down by chronic disease.

Increase in urine.

Œdema.

Ascites.

Aspect of patient.

There is a marked tendency to inflammation, showing itself most often in the lungs as pneumonia, next in order of frequency as pleurisy; inflammation of the pericardium and peritoneum sometimes occurs, but less often. Pneumonia in particular is more frequent in grown persons suffering from this disease than in either of the other forms of renal malady. Pericarditis is less common than with granular degeneration, more common than with nephritis. Bronchitis can hardly be regarded as a concomitant of this disorder. There is, as with other forms of renal disease, a tendency to erysipelas or to inflammation of the cellular tissue.

Inflammatory attacks.

Pneumonia most common.

Other morbid tendencies mark the course of the disease. Some of these result not directly from the state of the kidney, but from the concurrent progress of the disease in other organs. The diseased vessels of the alimentary canal secrete extravagantly, and give rise to diarrhœa and vomiting. The

Other complications.

frequency and severity of these affections are characteristic.

Diarrhœa.

Diarrhœa in particular, which seldom occurs with the other forms of albuminuria, is a most common and most fatal result of this. The motions are watery and very frequent; there is no pain or griping. The diarrhœa often recurs again and again, after having been as often checked by remedies, clears away any œdema which may remain, gives a pinched and sunken aspect to the patient, and eventually carries him to his grave. When this has been the case, it is found that the small intestine has been affected so that the vessels of the mucous membrane give the iodine reaction.

Vomiting.

Vomiting similarly indicates the change in the vessels of the stomach, a change which allows a morbid exudation to take place into the cavity of the organ. It often begins with loss of appetite and nausea after food.

Epistaxis.

A liability to bleeding from the nose, and to purpura, though not common, is sometimes noticed.

Cerebral symptoms uncommon.

As a counterpoise to these dangers, it is found that patients suffering with this disease are but little liable to the affections of the brain, which have been described as uræmic. Such attacks are the exception, not—as with other forms of renal disease—the rule. Convulsive seizures are more common than simple coma. In a series of 48 cases, all with marked symptoms of the renal disease, and all exhibiting it on post-mortem examination, there occurred 3 instances of uræmic convulsions, 2 of simple coma, 1 of unnatural drowsiness. This is a proportion of nervous disturbance infinitely below what occurs in albuminuria from other causes.

The freedom from these affections probably depends upon the fact that the constituents of the urine are much less diminished than in other diseases of the kidney, while death is often due to the progress of the disease in the bowels.

Causes of death; diarrhœa most common.

The most frequent cause of death in this disease is diarrhœa; the next pneumonia. Inflammation of the serous membranes, though very common, seldom causes death, unless the membrane affected be the peritoneum. Looking at the cause of death, as far as it could be isolated, in 35 cases in which that result was apparently due to the renal disorder, it was found that

Diarrhœa was the chief cause of death in 13 cases.
Pneumonia „ „ „ „ 7 „
Peritonitis „ „ „ „ 4 „
Convulsions or Coma „ „ „ 3 „
Pleurisy (one associated with erysipelas) 2 „
Ascites (liver affected and tapping performed) 1 „

Excessive general dropsy, vomiting, bronchitis, enteritis, and coagulation of blood in the pulmonary artery, each contributed one death; while pericarditis and erysipelas, though apparently not the chief cause of death in any case, were present in some instances.

Thus it appears that the tendency to death is by inflammation of the lungs and serous membranes, or by exhausting diarrhœa. In the frequency of the latter complication and the comparative immunity from head symptoms, the disorder differs from other forms of renal disease. It resembles them in the liability to inflammatory attacks.

There appears to be no tendency to atheroma of the vessels, to hypertrophy of the heart, to extravasation of blood in the brain, or to affection of the retina.

The following table gives an abstract of the symptoms observed in 48 cases in which the disease arose independently of any other renal affection.

Table showing Symptoms and Results of Depurative Disease of the Kidney, derived from Analysis of 48 *cases under the observation of the Author, in all of which a post-mortem examination was made. Those cases only are included in which the disease had progressed far enough to cause albuminuria, and other symptoms referrable to the kidneys.*[*]

Hæmaturia (blood evident without microscope)	4
Frequency of Micturition	4
Pain in Loins	5
Œdema	33

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[*] Cases in which the disorder appeared to be consequent upon some other form of kidney disease have not been included.

Ascites	12
Hydrothorax	1
Fluid in Pericardium	0
Erysipelas, or Inflammation of Cellular Tissue	3
Uræmic Convulsions	3
Simple Coma, or Semi-coma	2
Other head symptoms	1
Pneumonia	9
Pleurisy (present in a recent state at time of death)	5
Peritonitis ,, ,, ,, ,,	4
Pericarditis ,, ,, ,, ,,	3
Endocarditis ,, ,, ,, ,,	1
Bronchitis	1
Vomiting (not of blood)	11
Diarrhœa (motions in 1 case bloody)	22
Enteritis	1
Amaurosis, or dimness of sight	0
Sanguineous Apoplexy	0
Epistaxis	2
Purpura	2
Vomiting of Blood	0
Hypertrophy of Heart (simple)	1
Atheroma of Arteries	1
Gout	2

URINE.

The urine in this disorder resembles in many particulars that which belongs to granular degeneration. A general rule holds good, that the urine is diminished by obstruction of the tubes, increased by disease confined to the intertubular structures.

Early increase.

Low sp. gr.

Gradually becomes albuminous.

The first change in the urine in this disease is an increase of quantity. The amount varies from the normal average up to perhaps four times as much. Dr. Grainger Stewart places the maximum at 200 oz. in the twenty-four hours. I have never seen so much. The common range at the earlier periods of the disease is from 50 to 90 oz. The urine thus increased is pale, clear, and watery. It has a low specific gravity, 1015 to 1006, or even less. When the increase becomes obvious, or soon afterwards, a trace of albumen appears. Commencing always in minute quantity, it slowly increases until it is sufficient to form a bulky coagulum. Towards the later periods of the disease, the secretion generally becomes reduced in quantity. This appears to depend either upon the presence of a certain amount of tubal catarrh, or upon a large proportion of the tubes being stopped up by the fibrinous exudation. Upon whatever cause it may depend, the occurrence is very general in the later periods of the disease. The urine falls to its natural quantity, and often below. Sometimes it is reduced to 8 or 10 oz. in the twenty-four hours, but this is uncommon; it comparatively seldom falls below 20. The extreme diminution which is characteristic of nephritis does not occur. When the urine has become thus reduced in quantity, it is generally highly albuminous.

Quantity finally reduced.

Diminution seldom extreme.

The acidity of the urine is decreased in this, as in other forms of albuminuria.

Loss of acidity.

Blood is but rarely present, less often than with granular degeneration, much less often than with nephritis. In a series of 48 cases of the depurative disease, in which the urine was examined during life and the body after death, there were but 4 in which the secretion was obviously discoloured with blood. In all these cases, however, the hæmorrhage was considerable; in one, constant and profuse.

Hematuria rare.

Casts, etc.

Casts make their appearance at a very early period, while the albumen may be yet a mere trace, and they increase in abundance as the disease progresses. Although there are no casts which are peculiar to this complaint, if we except those rarely found which give the iodine reaction, those which more especially belong to it are simple cylinders of fibrine. These may be large or small, according to circumstances, and may be frequently dotted with oil as the consequence of a change within themselves. Such casts are almost always present in this disorder, though they are not confined to it. They are generally of small or moderate diameter, evidently formed in tubes which retain their epithelial lining; sometimes their larger size and stouter make shows them to have proceeded from tubes either denuded or much dilated.

Sometimes give reaction.

Simply fibrinous or epithelial.

Besides these, casts sometimes occur which contain, or chiefly consist of, epithelial cells, and when these are present, loose cells of the same nature often abound. In such cases (Carter, p. 220), a catarrh of the tubes has been superadded to the primary disease. The engraving (plate 7, fig. 2) includes all the varieties of casts which were found in the cases upon which this account of the disease is based.

It is by no means rare, when the urine is scanty, to find a deposit of uric acid or urate of soda.

CHEMICAL CHARACTERS OF THE URINE.

Urea not greatly diminished.

Urea.—More or less reduced in quantity. While the urine exceeds its proper amount, that is, during the greater part of the disease, this important constituent falls but little below the normal amount. Towards the end, when the urine is scanty, it is more sparingly excreted, but it never approaches the degree of diminution which results from the other forms of renal disease.

Among many cases in which I have ascertained the daily amount, I have never chanced to find the quantity below 7 grammes. The ordinary range is from half to two-thirds the normal quantity. In 7 cases in which the urea was estimated, it varied from 7·35 to 24·9 grammes.

A case is related by Rosenstein,* in which the urine became reduced to an unusually small quantity, and the urea fell as low as 3·6 grammes in the twenty-four hours; but this must be regarded as an unusual circumstance. It may be stated as a general rule, that so long as the urine exceeds, or does not fall short of, the proper quantity, the urea will not be greatly diminished.

Varies.

Uric Acid.—Sometimes normal, more often diminished in quantity, occasionally absent. In two cases under my own care in the hospital I was unable to discover any.

Phosphoric Acid.—Always reduced, diminished with constancy in well-marked cases of the disease to a sixth or even a smaller proportion of its proper amount. The reduction of this constituent appears to be more regular than with either of the other forms of renal disease, though it seldom reaches their minimum.

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* Frau Meller, p. 246.

Constantly diminished.

Sulphuric Acid.—Much less reduced than the phosphoric. Nearly always more abundant than that acid, though in health it exists in smaller quantity. This is much what occurs with granular degeneration.

Reduced to less extent than phosphoric.

Chlorine.—It appears that the chlorine, though reduced to a less extent than occurs in nephritis, is diminished more than, as a rule, occurs with granular degeneration. It is perhaps not necessary to give a detailed account of the analyses which have been made, as the cases reported will bear out the statements with regard to this and the other constituents of the urine.

Diminished.

Alkaline and Earthy Salts.—The alkaline salts in this disease appear to be below the normal amount. In the cases of King (p. 201), and Gilbert (p. 216), both potash and soda were greatly reduced, especially the latter. In these cases a purulent discharge was flowing at the time of the examination. How far these alkalies are reduced when the renal disease is present under other circumstances, and what proportion they bear to their amount in other forms of albuminuria, are questions as yet unanswered.

Alkalies diminished.

Abnormal Constituents.—Nothing remains to be added to what has been said about albumen. It is less abundant in this disease than in nephritis; more, as a rule, than with granular degeneration.

Summing up the chemical changes which occur in the urine as a consequence of the depurative change in the kidney, they are as follows:—

Summary.

The water is increased except in cases of long standing, when it is frequently diminished. With this exception, all the elements of the urine are diminished. The urea is reduced, but not to the extent which occurs with other forms of renal disease.

The amount of uric acid is variable.

Of the mineral constituents, that which is diminished with the greatest regularity is the phosphoric acid.

The following cases, together with those placed after the section upon treatment, illustrate the pathology and symptoms of the disease.

Cases.

Dilatation of Bronchial Tubes, with profuse suppuration. Amount of Alkali lost daily. 'Depurative' disease, Albuminuria, Diarrhœa. Treatment by tonics and salts of potass. Death. Post-mortem examination.

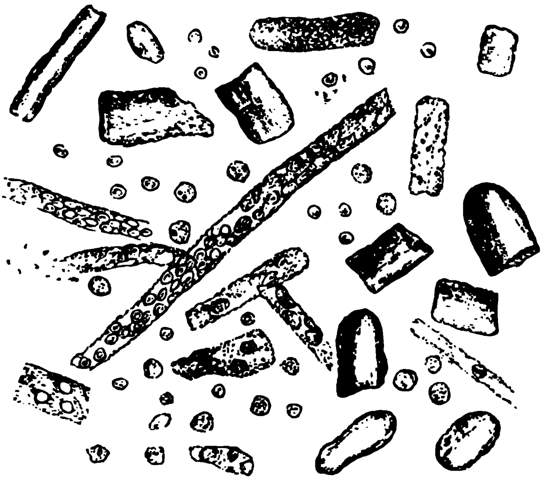
Fanny White, aged six years, became my patient in the Children's Hospital, Jan. 29, 1866.

She had had cough since birth. At the age of two years she had a severe attack of whooping cough, after which the former symptoms continued, with gradually increasing expectoration. For the last two years she had been easily put out of breath, and the least excitement caused much cough. For six or eight months she had been pallid and emaciated, and a month ago the feet swelled. The urine on examination was found to be albuminous, and she was thereupon admitted.

She was pale and puffy; the legs were œdematous. There was much cough, attended with copious purulent expectoration, which had an odour suggestive of gangrene. There was slight general dullness over both lungs, which gradually increased from above downwards. The apices were nearly natural on percussion; it was thought that the right was rather the less resonant. The dullness over the lower lobes was very decided. Large bubbling and cavernous sounds were heard all over the chest, especially low down. The voice sounds were slightly increased. From these signs, as well as from the general symptoms, it was thought that the lungs were excavated by vomicæ, the lower lobes more than the upper.

The pulse was quick, the appetite bad, the bowels regular.

The urine was repeatedly examined: it was always scanty, varying from 350 to 500 C.C. in the twenty-four hours. The specific gravity varied from 1014 to 1023. It was highly albuminous, sometimes turning nearly solid when boiled. It threw down, very generally, crystals of uric acid. Under the microscope abundant casts were seen, mostly of considerable diameter and uniform waxy character. Besides these, other casts were found which contained blood globules and epithelial cells. Loose cells of renal epithelium were scattered about, some of which approached pus globules in character.



Urinary Deposit, Fanny White. Loose renal epithelium. Hyaline and epithelial Casts.

The purulent discharge, which was regarded as the origin of the mischief, was examined. It was found that a quantity not varying much from 105 C.C., or about 3 oz., was spat up every day. It was alkaline; it had the appearance of unmixed pus; the odour was offensive. This contained ·932 of ash, ·877 soluble in water, ·055 insoluble. The soluble ash contained of potash ·089, soda ·275. These numbers represent the amounts contained in twenty-four hours' expectoration.

The child was put upon liberal diet, with wine. She had cod-liver oil with reduced iron, and as a means of compensating for the loss by the discharge, she was ordered a mixture containing citrate of potass, which was associated with cinchona and squills. She went on well for a time, but had frequent attacks of diarrhœa, which were supposed to depend upon the extension of the disease to the bowels. These were held in check for a time by the use of injections of starch and laudanum, and subsequently by astringent medicines, of which sulphate of copper and opium were found to be most effectual. By March 2 the disease had evidently made progress; the child had perceptibly wasted and become weaker; the expectoration was more profuse and offensive. Two days later she was taken out by her parents, the same treatment being pursued while she was at home. She gradually sunk, and died on the 11th.

Post-mortem.

Permission was obtained to examine the body. It was much emaciated. The pleural cavities were closed by old adhesions. The upper lobes of both lungs were emphysematous, but otherwise natural. The lower lobes were almost entirely occupied by large globular or oval cavities, which varied in size from a walnut downwards, most of them approaching the size mentioned. These proved to be simple dilatations of the bronchial tubes. These, where they entered the lower lobes, dilated into large cavities, each like a flask, with a narrow neck and a large body. Tracing down any one of the large bronchi, it was found to divide into smaller tubes, each of which terminated in an oval cavity such as has been described. These were lined by a mucous membrane continuous with that belonging to the bronchial tubes, and resembling it closely. These cavities were not surrounded by any consolidation such as usually abounds in the neighbourhood of vomicæ; their walls were no stiffer than ordinary mucous membrane. In many places the walls of the cavities were in contact with those adjoining. The bronchial membrane was generally injected, and the dilatations were loaded with pus. A small part of the lower lobe of the left lung was occupied by ordinary red hepatization. A few places were noticed near the thin edges of the lobes, where a little fibroid tissue separated the cavities. There was not a tubercle in the lungs or in any other part of the body.

The heart was natural.

The liver was enlarged, fatty, and gave slight iodine reaction.

Both the large and small intestine were extensively altered in the same manner, the characteristic test being given by iodine in a very marked manner.

The kidneys were enlarged to about the size proper to the adult. The capsules were slightly thickened and adherent; the surfaces were smooth, very pale, but showing stellate veins. On section there was a general look of unnatural uniformity, cortex and cones partaking of the same pale buff colour. Iodine gave the peculiar reaction upon the malpighian bodies, and upon many of the straight vessels of the cones.

Under the microscope it was found that the cortical tubes were in some instances open, while others were stuffed with epithelium. The cells taken separately were quite natural. The malpighian bodies were enlarged and their capsules were dilated into globular cavities.

Comments. This case is interesting in several respects. The primary disease, dilatation of the bronchial tubes, is one of rare occurrence, and one which is usually mistaken, as in the present case, for phthisis. The complete absence of tubercle, however, shows that the secondary disorder did not depend upon any scrofulous cachexia. The daily discharge of pus was very great, and at once led to a suspicion that the disease was of the 'depurative' kind, a suspicion which was converted into a certainty when the waxy casts were found, and diarrhœa became a prominent symptom. The fact that beside simple fibrinous casts, casts were found of the epithelial variety, beside scattered cells of renal epithelium, more or less puriform in character, showed that, as is often the case, a certain amount of tubal inflammation had been superadded to the original change. With this the urine became scanty. After death many of the renal tubes were found obstructed by epithelium. The treatment which was adopted was warranted by experience, so far as the liberal diet, cod-liver oil and iron, were concerned. The citrate of potass was given in order to compensate for the loss in the discharge. Like most cases of this variety of renal disease, the patient sank worn out by the primary disease and by diarrhœa, never having had any cerebral or proper uræmic symptoms.

Strumous Disease of Wrist, with profuse suppuration. Phthisis. Urine increased and albuminous. Analysis of Urine. Thirst. Œdema. Diarrhœa. Death from exhaustion. Post-mortem examination. Estimation of potash and soda in liver.

On October 1, 1866, I was asked by Mr. H. Lee to examine one of his hospital patients with regard to the medical aspects of a proposed operation.

The patient was a labourer, named John King, twenty-six years of age. According to his own account he had, seven months previously, sprained his right wrist by carrying a weight; a few days afterwards the joint became painful, and two months later the disease had progressed so far that a sinus had formed which discharged pus. The purulent discharge became very profuse, amounting, according to the man's own account, to a pint a day; an estimate which was exactly confirmed by the nurse of the ward, who put it down at 20 oz. A month after the abscess broke he began to cough, the cough after a time being accompanied with purulent expectoration. Within the last two months the urine had increased in quantity and in frequency of passing; he suffered from thirst—'drouth,' as he called it—and the bowels became loose. Latterly the legs became œdematous, the urine still remaining in excess.

When I saw him he was much sunk and wasted. There was much soft œdema about the ankles; no enlargement could be felt of the liver or spleen. He had a cough, with muco-purulent expectoration; and on listening at the chest, dullness, increased voice sounds, and large bubbling, were heard at the right apex. There was not much thirst, the tongue was red and raw-looking, the pulse 108. There was extensive disease of the bones belonging to the right hand and forearm, with numerous openings, which discharged now about a quarter of a pint of pus daily.

The urine was collected for the twenty-four hours ending October 1. It was acid, slightly turbid.

Quantity	=2040· (or 72 oz.)	
Sp. gr.	=1007·	
Urea	= 22·4	grammes
Uric Acid	= 0·0	„
Phosphoric Acid	= ·51	„
Sulphuric Acid	= ·969	„
Chlorine	= ·948	„
Soluble Ash	= 4·263	„
Insoluble Ash	= ·265	„
Potash.	= 1·453	„
Soda	= ·723	„

Under the microscope many slender casts were seen, such as are represented in plate 7, fig. 2. These were simple cylinders of fibrine, more or less dotted with specks of oil. They were treated with a solution of iodine, but did not become more deeply coloured than the scales of epithelium and other objects which came in the way of the fluid.

The opinion which was given was to the effect that the kidneys and the bowels were affected by the waxy or depurative deposit, and that in addition the right lung was the seat of advanced tubercular disease. Any serious operation was of course out of the question.

From this time, in spite of the most liberal and varied diet, he gradually sank. The expectoration continued in considerable quantity, but the discharge from the wrist became less. The diarrhœa at last was less frequent. The urine remained copious, while the œdema and thirst persisted. On October 13 he died, without any further symptoms.

Post-mortem. At the post-mortem examination it was found that all the carpal bones, the ends of the metacarpal bones, and of the ulna and radius, were bathed in pus, and were soft enough to be cut with a knife. The ulna protruded from a wound at the back of the wrist.

Both lungs contained much crude tubercle, and at both apices were vomicæ, that on the right side being large and ragged.

The liver was of about natural size; it was pale, and gave with iodine the characteristic reaction. This reaction took place in a decided manner, but to a comparatively small extent. The spleen was natural in size and appearance, but with iodine became closely dotted over with very characteristic brown specks.

The kidneys were increased in size; one weighed 7½ oz., the other about the same. The capsules were slightly adherent, the surfaces mottled with vascularity. The cortex was increased, generally white and coarse in texture. With iodine the malpighian bodies were brought out in strong relief, looking like grains of brown sand sprinkled upon the surface.

Under the microscope it was found that the epithelium was very fatty, as is often the case when the depurative change has taken place.

The small intestine was coloured in the same characteristic manner. In both the large and small bowel were several small, clean cut ulcers, such as result from tubercular disease.

Subsequently 100 grammes of the liver were reduced to an ash, and the potass and soda estimated. The following are the results. The healthy averages are annexed for comparison; the amounts are given in grammes.

	John King	Average of Health
Soluble Ash	·481	1·00
Insoluble Ash	·209	·181
Potash	·12	·169
Soda	·053	·156

Comments. This case is a good example of the class to which it belongs. The disease arose from suppuration, which though it had continued for a shorter time than is generally the case, was in unusually large amount. The sinuses opened only five months before the death of the patient, but there was evidence to show that for a time as much as a pint of pus had been discharged daily.

The symptoms were as characteristic as the history. The urine albuminous and increased in quantity; notwithstanding the excess, œdema; the patient reduced by a watery flux from the bowels, sinking at last without any cerebral disturbance. These things, even without the history of suppuration, would suffice to make the diagnosis almost a matter of certainty. The abundance and character of the fibrinous casts, and the fair proportion of urea which still passed, are also distinctive.

The circumstance in particular, that œdema increases while the water is in excess, appears to be peculiar to this form of albuminuria. It is probable that the effusion depends upon the extension of the disease to the blood vessels of the cellular tissue, rather than, as in other forms of renal disease, upon an alteration in the blood. The deteriorated vessels allow the serum to transude. The thirst which is present in such cases is probably consequent upon the multiplied demand for fluid which is passing off by diuresis, from the bowels, and into the cellular tissue. The deficiency of the alkalies in the liver was extreme, although on the application of iodine the brown colour did not come out over so large a proportion of the section as is sometimes the case. The discharge continued up to the time of death, and it is probable that with so large a drain, the proportion of alkali suffered not only by the deposition of the specific dealkalized matter, but by the removal of all spare alkali from the blood and tissues. Where the discharge has ceased, or has much diminished, before death, so that the tissues are enabled to recover their ordinary condition, alkali is only wanting in the new material.

It may be believed that in cases like this one, where a profuse purulent discharge exists, the potash and soda of the urine suffer diminution. In health the daily amount of potash varies, according to Dr. Parkes, from 1·7 to 7·6 grs. In this case the amount was below the minimum. Soda, which in health exists in larger quantity than potash, was here in smaller. Observations, however, both in health and disease, are too few to give safe conclusions.

Disease of the Hip-joint, with profuse and protracted discharge. Phthisis. Depurative Affection of Liver, Spleen, Kidneys and Bowels. Death. Post-mortem examination.

Last October I was asked by Mr. H. Lee to examine one of his hospital patients, with a view of considering whether her state of health was such as to allow of an operation.

E. R., seventeen years of age, a pale slender girl, began three years before to have pain in the right hip and knee. Fourteen months ago an abscess connected with the hip began to discharge, and continued to do so since. When seen, the discharge was estimated by the nurse at a quarter of a pint daily. There was cough, with muco-purulent expectoration, and evidence of phthisis, on which it is not necessary to dwell. The abdomen was somewhat tumid, owing to visceral enlargement. The outline of the liver could be traced about an inch below the umbilicus, while the spleen could be felt projecting 2½ inches below the ribs, and reaching backwards towards the lumbar region.

The bowels were quiet, the tongue clean but tremulous, the pulse 124.

The urine collected for twenty-four hours amounted to 53 oz., or 1500 C.C. It was acid and natural in appearance. It contained a considerable quantity of albumen. It was examined under the microscope, but no casts could be found. The urea contained in the whole quantity amounted to 18·0 grammes. There were traces of uric acid.

Under the circumstances it was clear that there was waxy infiltration of the liver, spleen, and kidneys, beside which there was tubercular deposit in the lungs. An opinion was given to this effect; all idea of operation was abandoned, and the girl left the hospital in November.

From this time, until her death, she was frequently visited at her own home by Mr. Pick, the able and energetic curator of the Hospital Museum, who has furnished the conclusion of the case. The length of time she lived was a matter of surprise. She had cough with constant expectoration. Diarrhœa often came on, but was held in check by opium. Vomiting was frequent. She became very œdematous. A discharge first of blood and then of pus began to pass from the vagina, and at the end of May she sank, after an attack of hæmoptysis.

Post-mortem. The friends would not consent to an examination of any part of the body excepting the hip-joint. Through an opening made for this purpose, portions of the liver, bowel, and kidney were extracted. The liver was fatty, enormously enlarged, and loaded with the waxy deposit. It gave the iodine reaction in the most characteristic manner, as did the mucous membrane of the small intestine. The kidney was pale, enlarged, waxy in look, and gave the reaction upon the malpighian bodies and cones.

The hip-joint was entirely destroyed, the cartilages gone, the bone carious.

Comments. This case is one of a large class. Whatever doubts may attend their surgical management, the diagnosis is a matter about which it is nearly impossible to err. An obvious and profuse discharge, followed by palpable enlargement of the liver and spleen, albuminous urine and diarrhœa, are a series of phenomena which have but one explanation. In the present instance the co-existence of the phthisis would have rendered futile any operative proceeding; but had the lungs been sound, and had the case come under treatment at an earlier stage, it is not unreasonable to suppose that the removal, were that possible, of the diseased bone might have arrested the disease.

Necrosis of Lower Jaw, with protracted purulent discharge. Consequent depurative change in kidneys. Albuminuria. General Dropsy. Diarrhœa and Vomiting. Death by exhaustion. Post-mortem examination.

Richard Harrington, twenty-six years of age, a tin-plate worker, came into St. George's Hospital under the care of Dr. Wilson, July 10, 1856. He had had syphilis five years before, and had since had sores about his body. For the last three years he had had an opening on the right side of the face, over the lower jaw, from which matter was constantly discharged. He was temperate in his use of liquor. He had never had scarlatina. His general health had been good until nine weeks before his admission, when he had what he described as a cold, with tightness of the chest and running at the nose. Three weeks later his legs began to swell, and he felt weak, and 'bodily ill.' Nothing was known to have been amiss with the urine until five or six mornings before his admission, when he once noticed it to be dark like porter.

When he was seen his face was puffy, the legs œdematous, and covered with a red blush. There was a fluctuating swelling of the abdomen. Behind the lower parts of both pleuræ there was want of breathing and of resonance. He had pain over the cardiac region, increased by motion and by deep pressure. There was slight cough. Pulse weak, 116. The urine was scanty, so albuminous as to become almost gelatinous with heat and acid. Sp. gr. 1029. It was often examined during the progress of the case, but did not change materially; it was of great specific gravity, sometimes as high as 1034. The amount of albumen remained such that it was often difficult to boil the urine without causing an explosion. The casts were the cylinders of fibrine represented in plate 7, fig. 2, of small diameter, rounded outline, and more or less dotted with specks of oil. Some of them contained epithelial cells.

The dropsy gradually increased in the cellular tissue, the belly and the left pleura. There was occasional cramp in the calves. About the beginning of August the patient began to suffer from diarrhœa, and the œdema diminished; vomiting then came on, which accelerated the removal of the fluid, so that by August 17 the swelling was only perceptible below the knees, whereas formerly the limbs had been wholly distended. All the fluid had been removed from the peritoneum. The gums were now sore, and the breath fœtid, as if from mercury, though none had been given. There was pain about the larynx, increased by speech. The diarrhœa still continued, imperfectly held in check by remedies, and the vomiting occurred frequently. All traces of dropsy now disappeared, and the patient wore a shrunken, pinched look. The motions latterly were described as resembling yeast. On the 26th he sank, the vomiting and diarrhœa remaining to the last. He died in full possession of his intellect. There had been no cerebral disturbance throughout.

Post-mortem.

At the post-mortem examination the body was much emaciated. There were traces of œdema in the lower extremities and in the scrotum. There was a large cicatrix on the front of the neck, such as would result from a burn or scald. On the right side of the face, at its lower part, was a large sloughing sore, at the bottom of which lay a large and perfectly loose portion of the ramus of the jaw, which had become necrosed.

There was a little turbid serum in the pericardium. The heart was healthy; the cavities were occupied by large and firm fibrinous clots. The right pleura was closed by old adhesions. Both lungs were loaded with serous fluid.

The liver was natural. The spleen was firm, but not enlarged.

The kidneys were the only viscera materially diseased. The two weighed 18 oz. The capsules were thin and loose, the surfaces smooth and pale, almost all the vascular markings having been effaced. A few stellate veins were seen On section the cortex was seen to be so much increased as to account solely for the increase of weight. It was excessively anæmic. The colour was like that of a parsnep. The cones, which appeared natural, were widely separated by the swollen cortex between them. The whole organ was firm. There were no cysts.

Under the microscope it was found that the epithelium was generally fatty; many of the cells in the cortical tubes were swollen by oil globules to five or six times their natural size. Many of the tubes were blocked up and distended by the accumulation of these cells. Many were $\frac{1}{300}$ of an inch in diameter, some wider still; others were bared of epithelium, and filled with clear fibrinous matter. The straight tubes were natural, excepting that some contained material exactly resembling that which formed the casts. The malpighian bodies had a lobular outline.

A portion of renal substance was hardened by boiling, and examined in section. The tubes were found to be very various in size, some distended, while in certain places there were collections of shrunk tubes. At the time the body was examined it was inferred, from the obstruction in the tubes, and the fatty change, that the disease was of tubal origin. The 'amyloid' or depurative disorder was not then understood. More than eight years afterwards, however, when acquainted with the consequences of suppuration, I was fortunately enabled to ascertain the real nature of this case. A portion of the kidney had been preserved, and the application of iodine to a section brought out the reaction characteristic of the change in a very striking manner.

Comments. This case, though it occurred before the 'amyloid' or waxy change was recognised, could from the history have been confidently stated as of this nature, even though it had not been possible to test the kidney.

Like many patients brought under notice with this disease, he did not seek advice until the urine had become scanty, as it often does in the later stages, in consequence of the obstruction of the tubes. The fatty change which existed is an alteration which very commonly accompanies the depurative disease. The preceding suppuration, the diarrhœa, and the consequent disappearance of dropsy, are characteristic, as is the absence of cerebral symptoms. Probably, had the man been questioned, with the light of our present knowledge, it would have been learned that at a period before his admission the urine was unnaturally copious.

General Waxy Infiltration following Dysentery, Syphilis, &c., in India. Post-mortem examination. Analysis of Liver. Doubts as to origin of Disorder.

James Barry, a discharged soldier, forty-five years of age, who had served fourteen years in Bengal, and suffered from fever, ague, syphilis, and dysentery, was frequently a patient at St. George's Hospital, alternately under Dr. Fuller and myself. He had a bronzed complexion and sharp features. He was emaciated, while the legs were very œdematous. The liver projected much below the ribs. This, with the characteristic appearance of the man, and the fact that his urine was loaded with albumen, led at once to the belief that he was the subject of waxy infiltration. He suffered much from vomiting and diarrhœa, became more wasted and prostrate, and finally sank, after having had a protracted attack of epistaxis.

Post-mortem.

At the post-mortem examination there was found a scar upon the penis, such as would result from a chancre.

There was a cicatrix at the apex of the left lung, with puckering of the surface and evident loss of lung tissue. Some quiescent tubercle occupied one of the bronchial glands.

The liver was tightly adherent to the diaphragm by old false membrane. The capsule was thickened, and presented on its surface a number of little pits or depressions. The organ was greatly increased in size, and on section presented a most characteristic 'waxy' aspect. Iodine produced the characteristic tint over a large proportion of the surface. In the centre of the right lobe was an irregular firm cream-coloured mass, as large as an orange, harder and tougher than tubercle, which under the microscope showed traces of a fibroid structure, and was presumed to be a syphilitic deposit.

The spleen and kidneys were also waxy, as was evident by their appearance and by the reaction of iodine. The intestines were in the same state throughout their entire course; they were free from ulcers and scars.

A most careful examination of the body failed to show any bone disease, or any appearance which could be interpreted as a certain record of extensive suppuration.

The liver, so extensively occupied by the waxy deposit, was examined in further detail. This was done with more than ordinary precaution, in consequence of the uncertainty which involved the origin of the disease.

The cut surface gave, with litmus, a decidedly acid reaction, which was imparted to water or spirit in which pieces of the organ were soaked.

The acid thus extracted proved to be non-volatile. The acid solutions, obtained as described, contained a large quantity of phosphoric as compared to the other mineral acids, and it was surmised that the reaction was due to the presence of acid phosphates. Whether due to this or to free acid, it appeared that the excess was rather relative than absolute, depending apparently upon deficiency of alkali rather than superabundance of acid. 100 grammes of the fresh liver were reduced to an ash, and the alkaline salts extracted in the usual manner. These amounted to ·633 grammes, the average of health being 1·00. An accident prevented the separate estimations of the potash and soda. The diminution in the mixed alkaline salts is quite enough to account for the unnatural acidity of the tissue. The earthy salts amounted to ·154 grammes, the normal average being ·057. This increase accords with what is generally found under the circumstances.

Comments. In this case the cause of the disease is a matter of some uncertainty. As with many of the worst cases of the disorder, it was of Indian origin. The patient had suffered from dysentery, though at the time of death (17 years afterwards) the mucous membrane of the bowels had regained its natural appearance. To what extent the dysentery was a source of purulent discharge it is impossible to ascertain. It appears that mucous membrane has a great power of recovery, the bowel often presenting a natural appearance though there is reason to believe that at some former time it has been severely ulcerated. The adhesions by which the liver was surrounded showed that that organ had been the centre of inflammatory action, and it is by no means improbable that the rounded concretions imbedded in its substance were the remains of large abscesses. Seventeen years had elapsed since the attack of dysentery, a time probably sufficient to produce a considerable alteration in any hepatic deposits consequent upon that disorder. Supposing the concretions to have been of this nature, a view to which I myself incline, the case falls into the category of those consequent upon severe tropical dysentery. But if the deposits were, as they were thought to be at the time of the post-mortem, associated, not with dysentery but with syphilis—an opinion which derives support from the partially fibroid structure of the formations—it is difficult to avoid connecting the waxy deposition with the syphilitic state, which under that view would be the only morbid condition which could be recognised as extensive or decided.

The case is reported as the only one in a large number in which there was any reason to suspect that the syphilitic cachexia was the source of the disease independently of the suppurative process.

Whatever was the source of the disorder, the dealkalized state of the new formation was remarkably clear. The acid reaction of the liver was striking. The proportion of alkali in this tissue was little more than half the normal amount.

CHAPTER XIII.

TREATMENT OF THE DEPURATIVE DISEASE.

Preventive.

THE treatment of this disease must be directed rather to prevention than cure. Where an obvious and accessible discharge is the source of the complaint, the first consideration must be its arrest. The mischief will extend so long as the drain continues, but no longer. Though further changes may take place in the parts already involved, those which have hitherto escaped are safe. It has been shown that small quantities of this waxy deposit frequently occur in connection with suppuration of a temporary character without producing symptoms; the timely cessation of the discharge saves the organs from serious damage. We cannot suppose that a structure once permeated by the new tissue can ever be restored to its former state; but the disease is not necessarily progressive, except in the parts primarily involved.

The means of arresting the disease at its source will be chiefly of a surgical nature. In a work of this character they can be indicated only in a general and most imperfect manner.

Medical aspect of surgical operations.

In cases where symptoms of the visceral change have become evident, attempts to manufacture false joints, attended as they are by a tedious and exhausting process, will probably give place to the more simple and speedy relief of amputation. The question must often be reduced to a simple alternative between life and limb. In cases where, from the position of the diseased bone or any other circumstance, amputation is out of the question, the occurrence or the apprehension of the depurative change will supply a reason for removing the source of irritation by any other practicable means.

Persons with albuminuria from this cause have a considerable healing power, though they are exposed to greater dangers than would commonly attend a surgical operation, and to some dangers different in kind from those which generally follow such a procedure. There can be no reason, on this ground, why a leg or an arm should not be removed, or why diseased bone should not be extracted from the hip-joint, in cases where the secondary disorder is in an early stage.

Dangers of resection.

Cases sometimes end fatally from this disease after long suppuration from excision of a joint, in which there could be little doubt that at the time of the operation indications of the change would have been found if especially sought, and in which, had amputation been then performed, there might have been room to hope that the mischief had not attained sufficient extent to prevent the recovery of the patient, or interfere with his subsequent health.

Considering that the early stages of this disorder are often without obvious symptoms, it becomes necessary, in every case where conservative surgery is contemplated, to enquire somewhat closely into the condition of the patient. With regard to the urine, whether it has increased in quantity or become ever so slightly albuminous; whether there is any enlargement of the liver or spleen, any tendency to diarrhœa, or any trace of œdema.

Considerations where complaint arises from phthisis.

Where the disease comes on from phthisis, the cause may be regarded as almost beyond reach. At the same time it seems, that with the establishment of the kidney disease, the tendency to the deposition of tubercles is lessened, or ceases altogether. It may easily be supposed that the system, drained of albumen by the kidneys, can no longer supply the albuminous matter necessary to the formation of tubercle. Be that as it may, the phthisis is apt in such cases to subside into a state of inactivity, in which it does not call for especial treatment. There are many cases, however, in which the lungs have received injuries which will prove fatal, before the secondary disorder has become prominent.

Dysentery.

When the disorder has sprung from dysentery, it commonly happens that that disease has long subsided by the time the renal symptoms attract attention; to these, then, treatment may be solely directed.

Syphilitic disease.

When from syphilitic affections, it frequently occurs that when the patient comes under treatment for albuminuria, a constitutional taint remains which will call for iodide of potassium, sarsaparilla, and remedies of that character.

Compensation, when discharge inevitable.

In cases where a suppurative drain is inevitable, we may attempt to counterbalance its effects by an animal and albuminous diet, while alkalies are given medicinally. Eggs furnish a convenient mode of giving albumen, and liquor potassæ, or liquor sodæ, given before meals, will be absorbed with little modification by the acids of the stomach. In addition to these, a certain amount of alkali may be given, as citrate or acetate, salts which are readily decomposed in the system, and which may help to make up for the loss produced by the discharge.

But although these measures have been used in several cases with much apparent benefit, further experience is needed before their effects can be regarded as ascertained. Putting albumen and alkali into the stomach is not a necessary equivalent for taking the same materials out of the blood. We cannot be sure, with our present knowledge, what changes these substances may undergo in digestion and assimilation. It cannot, however, be possible to doubt the importance of compensating in some such manner the loss involved in profuse suppuration. Such means of compensation need only be resorted to when no means exist by which the discharge can be stopped.

Treatment of symptoms.

Supposing that we have to encounter the disease, as is often the case, when the primary lesion no longer exists, has become only a matter of history, or has passed out of knowledge altogether, we have to deal with a disorder which is in its nature irremovable, and we may confine our attention to the mitigation of the symptoms.

Iron, with diuretics.

The cachectic and anæmic condition of such patients, makes it essential that they should be liberally fed. Salts of iron are usually beneficial. It is generally necessary, in consequence of the tendency to œdema, to combine ferruginous preparations with diuretics. The tincture of the perchloride, or the syrup of the iodide, may be given with nitrate of potass, iodide of potassium, or digitalis. Acetate of iron may be mixed with acetate of potass, or steel wine with the bitartrate.

When, owing to the occurrence of diarrhœa, or to the abundance of the urine, no dropsical effusion exists, diuretics will not be necessary, and probably nothing more will be called for than such ferruginous or specific medicines as have been found to suit the individual case. The syrup of the iodide of iron, or the tincture of the perchloride, may be associated, should there be a syphilitic history, with iodide of potassium.

Iodide of potassium.

Vapour baths.

Vapour baths are not so useful in this disease as with granular degeneration; the greater debility of the patient makes him less able to withstand their depressing influence, and the small tendency to uræmia renders them generally unnecessary.

Where there is tubercular disease, cod liver oil will of course be resorted to.

For diarrhœa, opium with astringents.

One of the worst features of the disorder is the tendency to diarrhœa, and one remedy after another will often be tried with only temporary benefit. Opium in such cases may be used without fear. The greatest benefit will often result from giving ten or fifteen drops of laudanum with the ferruginous and diuretic medicines. The intolerance of opium, which is so strongly marked with granular degeneration, does not exist with this disease, or at least not to a sufficient extent to be a source of danger. If small doses of opium alone fail to check the diarrhœa, they may be combined with astringents, as in the form of compound kino powder, or mixed with catechu or logwood. When such remedies fail, we must have resort to acetate of lead, and lastly to sulphate of copper, the latter being the most efficacious of all the drugs directed to this end. Both may be given in combination with small quantities of opium.

For dropsy, diuretics, &c.

If œdema or any form of dropsy become prominent, the treatment must be conducted on principles which have been laid down with regard to the other forms of renal disease. Diuretics in all their variety may be freely used; and the hydragogue purgatives may be resorted to, often with the most marked advantage, when the accumulation in any of the serous cavities has become a source of danger. The same may be said with regard to the rare attacks of uræmic convulsions. There can be no objection in such cases to the use of vigorous purgatives, the patient being at the same time sufficiently stimulated.

Uræmia.

It is not necessary to follow in detail the treatment of the several inflammatory and other complications of the disease, since what has been said with regard to other renal affections applies also to this.

The following case illustrates the pathology of the disease, as well as the line of treatment which it was thought advisable to adopt.

Disease of Pelvis, with suppuration. Consequent Waxy Enlargement of Liver and Spleen, with affection of Kidneys and Bowels. Œdema, Diarrhœa, Epistaxis, &c. Analysis of Urine. Temporary improvement under treatment. Death. Post-mortem examination.

Isaac Gilbert, thirteen years of age, was frequently a patient in St. George's Hospital, successively under Mr. Pollock, Dr. Barclay, and myself.

He came under medical observation October 17, 1866. He had long been under surgical care for disease of the pelvis. He had an open sore, which for the last four years had discharged pus freely from the neighbourhood of the sacrum, while another opening was in connection with each ilium. For a year there had been œdema of the legs; swelling of the body for somewhat longer.

The boy was very pallid. The swelling of the belly was evidently due to an increase in the size of the liver, which could be clearly felt as low as the umbilicus. The feet, legs, and genital organs were œdematous. There was cough, slight mucous expectoration, exaggerated breathing, and some want of resonance at the left apex. The bowels were loose, the tongue rather dry, and there was complaint of thirst. The nose frequently bled.

The urine in twenty-four hours amounted to 22 oz. or 680 C.C. It was acid. The albuminous clot occupied half the bulk of the fluid. Delicate transparent fibrinous casts were found, some of which contained epithelial cells, others oil globules.

The following are the amounts of the several constituents passed during twenty-four hours.

Urea	9·36	grammes
Uric Acid . . .	·149	„
Phosphoric Acid . .	·136	„
Sulphuric Acid . .	·51	„
Chlorine . . .	1·08	„
Soluble Ash . . .	2·516	„
Insoluble Ash . .	·163	„
Potash . . .	·707	„
Soda	·802	„

The patient shortly after this date became an out-patient, and took persistently cod liver oil with a mixture containing liquor potassæ and liquor sodæ, beside astringents or diuretics, when called for by the diarrhœa or œdema.

He seemed to improve for a time, but in February the dropsy again increased, and he was readmitted. The belly was now tense and prominent, the surface covered with large veins. Hard masses could be felt in the position of the liver and spleen. The œdema was considerable over the lower extremities, scrotum, and penis. The bowels were loose. The discharge continued, and he was in much the same state as when first seen. The urine was highly albuminous (alb.=½). It is not necessary to follow the treatment in detail. His diet was of a liberal kind, including eggs and gin. He took salts of iron, cod liver oil, and the alkalies. Liquor potassæ was given in solution, associated with citrate of iron; or when a diuretic action was needed, acetate of potass and acetate of iron were given together, while the alkalies were combined with the cod liver oil. Three drachms of cod liver oil, with liq. potassæ ♏ xv., the same quantity of liq. sodæ, and a sufficiency of water, formed a mixture which was taken for a considerable time without objection. The diarrhœa was held in abeyance by the addition of a few minims of laudanum to the ferruginous medicine. Under these measures the health improved in every respect, the œdema almost disappeared, and the pallor diminished.

He, however, got tired of the hospital, and left on April 5. On May 7 he sank somewhat suddenly.

Post-mortem. It was not possible to make a complete examination of the body; but under circumstances of difficulty an incision was made in the abdomen, and a portion of liver and small intestine extracted. The peritoneum was occupied by recent adhesions, peritonitis having probably been the cause of death. The liver and spleen were both greatly enlarged. A portion of the former which was taken out was highly waxy in appearance, and with iodine gave the test-colour in the most intense manner. The affected tissue came out as black spots, separated by a network which gave no reaction. The mucous membrane of the coil of intestine removed was affected in an equally characteristic way.

Comments. The case calls for few remarks. It is almost typical of the depurative affection. The improvement under treatment was very decided, notwithstanding that the extensive disease both of the pelvis and of the viscera gave a very unpromising character to the case. The diarrhœa was completely under control, although, as ultimately proved, the change in the intestine was extreme. There were no uræmic symptoms from first to last. Death was apparently due to peritonitis, a complication which, though less common than pneumonia, is fatal in a considerable proportion of cases. Epistaxis, though not uncommon in this disease, is less frequent than with the granular kidney.

The cases which follow are examples of the disease in its relation to operative surgery.

Disease of Knee-joint, with discharge of pus. Resection. Sudden death after the operation. Disease of Kidneys not discovered during life. Coagula in Heart.

Emma Denman, aged nineteen, had disease of the knee-joint for the last ten years of her life. For the last fourteen months pus had been discharged from openings which had formed in the vicinity. She became a patient in St. George's Hospital, and the ends of the bones were excised. On the sixth day after the operation, the wound at this time looking well, 'she suddenly became faint and collapsed, and died in a few minutes.'

Post-mortem. The post-mortem examination was made by myself. The body was fat. The ends of the bones were coated with a thin layer of lymph, and the wound had a healthy appearance. Every part of the body was examined, but nothing was found to remark excepting the kidneys and the contents of certain blood vessels. The kidneys were enlarged, their surfaces were roughened, and their capsules adherent. Their substance was of a pale fawn-colour, an unnatural whiteness being disguised by congestion. The application of iodine brought out the characteristic 'amyloid' reaction on the malpighian bodies, the vessels of the cones, and also on some of the vessels of the cortex. The change was well marked, and must have been the result of disease of some standing. No such alteration was found elsewhere, though all the likely places were put to the same test.

The right auricle was distended with a mass of elastic semi-transparent fibrine. The other cavities of the heart contained similar fibrine, but in smaller quantities. The pulmonary arteries were occupied, but not distended, with soft black coagulum. The lungs themselves were natural. There was a small cylinder of buff-coloured fibrine lying in the left middle cerebral artery, close to its origin. This was such as to fill the vessel without distending it. The aorta and all the large vessels were free, as were all the other cerebral vessels.

The viscera, and every part of the body excepting those mentioned, were perfectly natural.

Comments.

Though the urine was not examined during life, there can be no doubt that it was albuminous. It is sufficiently evident that the kidneys had been long diseased. The suddenness and manner of death were such as would result from coagulation of blood in the cavities of the heart. The large mass of fibrine in the auricle was such as could not collect during the act of death, for death took place too rapidly to allow of the separation of fibrine to any considerable extent. The fibrine was deposited during life, and death occurred in consequence of the obstruction so produced. The inference that the fibrine had accumulated during life is borne out by the fact that a plug of the same material had been propelled into one of the cerebral arteries. The existence of albuminuria is known always to increase the proportion of fibrine in the blood, and in this case the protracted purulent discharge must necessarily have had an action of the same sort. The case furnishes an example of the tendency to formation of fibrinous coagula to which patients with the depurative disease are especially liable, though in every case of albuminuria there is more or less of the same proclivity. The operation, by weakening the powers of the circulation, appears to have acted as the exciting cause.

Abscess in connection with Diseased Knee. Excision of joint. Subsequent depurative disease of Kidneys complicated with Nephritis. Post-mortem examination.

At the beginning of the present year I was asked by Mr. Pollock to see a patient, then under his care in the hospital, whom he believed to be affected by the 'amyloid' disease. I saw her on Jan. 3.

The patient was a girl, sixteen years old, named Charlotte Carter, of whom the following particulars were learned. Two and a half years ago an abscess had opened in connection with the left knee-joint, which for some time previously had been swollen. The discharge continued. Last April the ends of the bones were excised by Mr. Holmes, who had charge of the case in Mr. Pollock's absence. The wound remained partially open, and the suppuration had continued ever since. Latterly the urine increased in quantity. For three weeks there had been frequent action of the bowels, with watery motions. A week after the commencement of the diarrhœa the sound leg became œdematous.

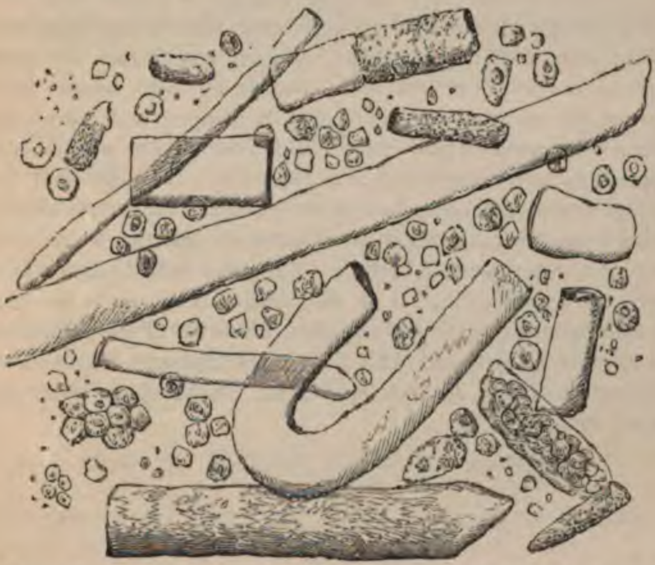
When I saw her she was white and puffy. There was still a good deal of œdema, but less than there had been. No enlargement of the liver or spleen could be detected. The bowels were loose—seven times in the previous twenty-four hours. There was much thirst; the tongue was dry and red; the pulse 104, so feeble as to be hardly perceptible. The appetite was still fair, so that she was able to make use of the liberal and stimulating diet which was provided. Pain in the loins was present, and had lasted for several weeks. The urine was now very scanty. A little was obtained with difficulty, in consequence of the disturbed state of the bowels. It was deep coloured and glutinous. It was loaded with albumen, so that it turned into a solid mass when boiled. There was not enough to give the specific gravity, or to allow of a chemical analysis. There was a very abundant sediment, of which the microscopic appearances are represented below. A great number of transparent waxy casts were present, many of large size. There were also granular casts, and others imbedding epithelial cells. Beside the casts, there was also a most plentiful deposit of loose cells of renal epithelium.

Under these circumstances there was no room for doubt as to the condition of the patient. She was regarded as having the peculiar change in the kidneys which is associated with protracted suppuration, upon which a state of tubal catarrh had been recently superadded. This diagnosis had been scarcely written down when signs of prostration rapidly increased, and she quietly sank without any fresh symptom. A little time before death the diarrhœa ceased. There were no head symptoms from first to last.

Post-mortem.

At the post-mortem examination the body was found to be fat and well nourished; the right leg œdematous.

The left knee was ankylosed, and there were several sinuses about the joint which led to softened and diseased bone; the end of the tibia proved also to be somewhat carious.



Urinary Deposit, Charlotte Carter. Loose Renal Epithelium, Hyaline and Epithelial Casts.

There was slight thickening of the mitral valve, and the aorta was slightly atheromatous.

The kidneys were greatly enlarged, together weighing 17½ oz. They were pale, but mottled with vascularity, the surfaces for the most part smooth and shining, though marked with a few small and incipient depressions. The cortex was very much increased, and loaded with an opaque yellow deposit, which had the appearance of being contained within a fine network of translucent grey material. In the right kidney were several fibrinous blocks, of old standing.

The malpighian bodies and lines on the cones gave a most marked iodine reaction.

With the microscope the epithelium was found to be perfectly natural. Some tubes were natural, or only unnatural insomuch as the epithelium was held in position with more than natural tenacity. Other tubes were distended almost to bursting, with a granular packing, which abounded with epithelial cells and nuclei. Many were about four times their proper width, and were swollen into an irregular shape. A transparent section showed that numerous processes of fibroid tissue had formed upon the surface, and insinuated themselves between the tubes at somewhat irregular intervals. Within some of these were contracted remains of tubular structure.

Comments. It is difficult to look back upon this case without suspecting that, had the limb been removed when the joint was excised, the result might have been more fortunate. During the nine months which followed the operation the wound was discharging, and the visceral mischief necessarily extending. The kidney disease was, as often happens, latterly complicated with nephritis. It would seem that the new deposit acts as an irritant to the organ. A careful enquiry in this instance failed to elicit any external circumstance which could have led to the superadded attack. The tubal inflammation was as clearly recognised during life as after death. The pain in the loins, the scantiness and highly albuminous character of the urine, the intermixture of epithelial with the simply fibrinous casts, and the abundant discharge of loose epithelium, combined to place this beyond doubt.

CHAPTER XIV.

COMPARATIVE VIEW OF THE THREE DISEASES WHICH HAVE BEEN CONSIDERED.

IT may be worth while to place in apposition some of the details which are spread over the preceding pages. A table relating to the ages selected by each disease, and another, showing the symptoms proper to each, have been compiled from the particulars which have been already given.

The following table and diagram show the distribution of each form of disease among the decennial periods of life.

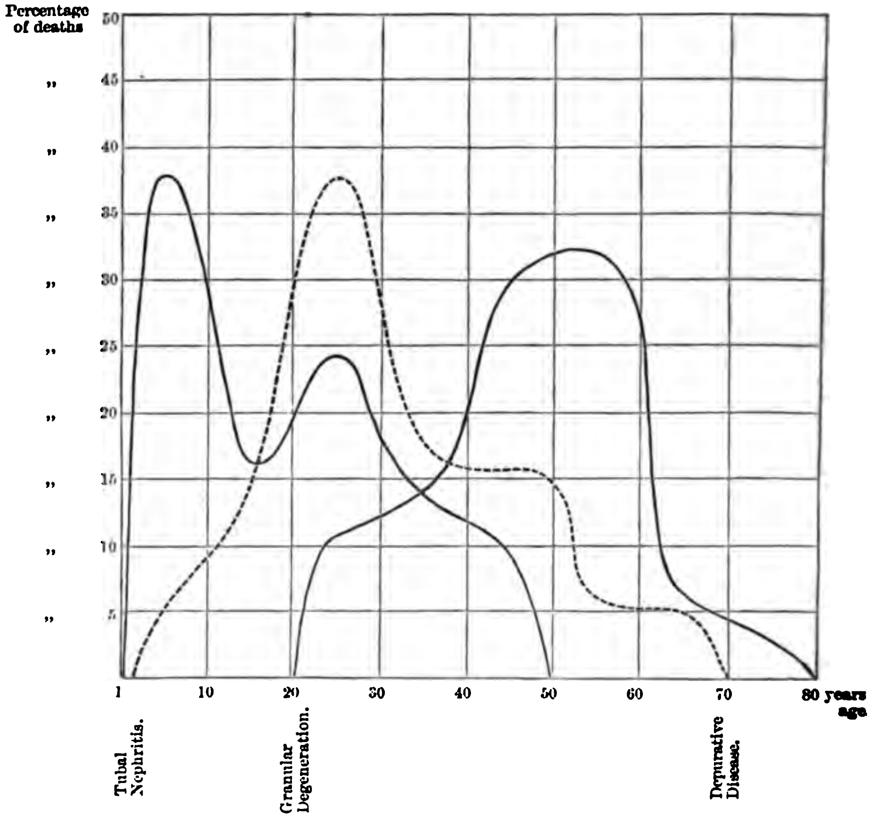
AGE, IN RELATION TO RENAL DISEASE.

Table showing Age at which the three forms of Renal Disease terminate fatally, calculated from cases under the observation of the Author.

PERCENTAGE OF CASES FATAL AT DIFFERENT PERIODS.

Age	Tubal Nephritis	Granular Degeneration	Depurative Disease
From 0 to 10	37	0	5
„ 11 „ 20	17	0	18
„ 21 „ 30	23	11	35
„ 31 „ 40	13	18	16
„ 41 „ 50	10	30	16
„ 51 „ 60	0	32	5
„ 61 „ 70	0	6	5
„ 71 „ 80	0	3	0

Diagram, constructed from the preceding Table, showing the Mortality produced by each Disease at the different periods of life. Each decade is represented by a vertical column, the mortality by the height of the curve.



Age selected by each disease.

It will be seen that nephritis is a disease of youth, causing more deaths in the first ten years of life than in any subsequent period of the same length.

Granular degeneration belongs to middle life and advancing age, and is most fatal between 50 and 60. Nephritis is unknown in old age. Granular degeneration is unknown in childhood and youth. The waxy infiltration, most common between 20 and 30, may occur at any time of life excepting infancy.

Comparison of symptoms.

The preceding table shows in numerical detail the clinical distinctions which separate the three diseases, which it is the object of the present work to distinguish. All the numbers given are necessarily below the truth in proportion as the symptoms which they represent are liable to evade notice.

Hæmaturia, &c.

Briefly reviewing the more important details, it is seen that hæmaturia and pain in the loins belong more especially to nephritis.

Dropsy.

Dropsical affections and their immediate consequences are by far the most frequent with nephritis; while they appear less common with the depurative disease than with granular degeneration. With regard, however, to the depurative change, it must be considered that many of the cases upon which the table is based terminated, as far as the kidneys were concerned, prematurely. Death was in not a few instances due mainly to the affection—phthisis or caries—from which the disease had sprung, and occurred before the renal symptoms had attained their full development. In cases which are able to progress to their renal ending, it is probable that dropsy is more common than with granular degeneration.

Inflammatory complications.

Pneumonia, pleurisy, peritonitis, and croup, more often result from nephritis than from the other varieties of renal disease. Inflammatory affections of the heart and its membranes are conspicuously the property of granular degeneration. Bronchitis, most common with granular degeneration, is often associated with the more acute disease.

Heart and blood vessels.

The tubal affection, though with a greater liability to dropsical and inflammatory complications, is nearly exempt from the disorders which belong to the circulating system. Hypertrophy of the heart is almost unknown as the consequence of any renal disease excepting granular degeneration. Hæmorrhagic affections, depending as they do upon changes in the structure of blood vessels, are seldom associated with the more acute disease. And they are more prone to result from the athermatous degeneration which accompanies the granular kidney, than from the morbid thickening of the waxy change.

Diarrh

Diarrhœa belongs especially to the depurative disorder. It occurs sometimes with nephritis; rarely with granular degeneration. Vomiting is more evenly distributed.

Vomiting.

With regard to both these symptoms, it appears that they may be associated either with uræmia or with the extension of the depurative change to the mucous membranes. When diarrhœa or vomiting is associated with the waxy kidney, the latter alteration has almost invariably happened.

Head symptoms.

With regard to head symptoms, the difference between the diseases is striking. Uræmic affections of the nervous system may be looked upon as the natural ending of the two disorders in which the structural change is essentially limited to the kidneys. With granular degeneration a larger proportion of the cases are fatal in this manner than with nephritis, where inflammatory complications so frequently cut short the course of the disease.

There is a difference in the nature of the attacks which each of these two disorders invites. Convulsions are of general occurrence with nephritis, while with the granular kidney though convulsive seizures frequently happen, there is a still greater liability to simple coma. With the depurative disease the tendency to uræmic attacks of either kind is but small.

Gout.

As to gout, it is pathologically associated only with the granular kidney. If it occurs with either of the other renal diseases, it is an accidental coincidence, a coincidence necessarily rare with simple nephritis, by reason of the youth of most of the victims.

Table showing the Percentage of Secondary and other Affections associated with the three forms of Albuminuria which have been described. Calculated from the tables already given.

	Tubal Nephritis	Granular Degeneration	Depurative Kidney
Urine, etc.—			
Hæmaturia	46·1	15·0	8·3
Frequency of Micturition	10·2	19·7	8·3
Pain in Loins	25·6	13·5	10·4
Dropsy, etc.—			
Œdema	97·4	72·0	68·7
Ascites	51·2	26·4	25·0
Hydrothorax	28·2	33·6	2·0
Fluid in Pericardium	2·5	4·3	—
Erysipelatous inflammation	20·5	4·3	6·2
Inflammatory—			
Pneumonia	25·6	10·2	18·7
Pleurisy	20·5	10·2	10·4
Peritonitis	12·8	4·3	8·3
Pericarditis	2·5	23·5	6·2
Endocarditis	—	5·8	2·0
Bronchitis	20·5	35·4	2·0
Enteritis	—	4·3	2·0
Croup and Diphtheria	10·2	—	—
Circulating system, Hæmorrhage, etc.			
Hypertrophy of Heart	—	45·4	2·0
Apoplexy (sanguineous)	—	4·3	—
Epistaxis	—	5·8	4·1
Hematemesis	—	4·3	—
Purpura	2·5	—	4·1
Affection of Retina	—	7·3	—
Mucous Fluxes—			
Vomiting	23·0	25·0	22·9
Diarrhœa	12·8	2·9	45·8
Uræmic affections of Brain—			
Convulsions	25·6	16·1	6·2
Coma, without convulsions	5·1	20·5	4·1
Other cerebral symptoms	10·2	19·7	2·0
Gout	—	23·5	4·1

CHAPTER XV.

STATE OF THE BLOOD IN ALBUMINURIA.

Knowledge scanty.

WITH our present information we are not able to make such distinctions between the condition of the blood in each of the forms of renal disease as the difference of the symptoms would lead us to expect. Our knowledge of the blood is but rudimentary, and is much less complete than our knowledge of urine. It is probable that in many cases the condition of the blood may be best arrived at by assuming that it varies inversely with that secretion. This holds good so far as the changes in the urine are produced by renal disease. Whichever of the urinary elements is absent or deficient in quantity is present in excess in the blood. If the urine contains anything which it should not, or has any of its constituents superabundant, the blood is robbed to a corresponding extent.

Blood varies inversely with urine.

Observations as to the state of the blood were made by Dr. Bostock in some of Bright's original cases, and soon afterwards by Dr. Christison* and Dr. Owen Rees. Analyses have since accumulated, but comparatively little has been added to what was thus early ascertained.

Generally speaking, the changes which are caused in the blood by albuminuria are these.

General alterations.

The albumen and the corpuscles are diminished. The water, the fibrin, the salts, the creatine, creatinine, and extractives are increased. Urea and uric acid are superadded. These statements hold good whether the kidneys be affected by nephritis, granular degeneration, or the depurative change.

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* Granular Degeneration of the Kidneys. 1839.

Taking the subject more in detail, and using only cases where the nature of the renal disease was ascertained by post-mortem examination, or was placed beyond doubt by other circumstances, the following particulars may be given with regard to each of these forms of renal disease. The numerical results of the analyses referred to, to save space, are arranged in a tabular form.

TUBAL NEPHRITIS.

In a fatal case of scarlatinal dropsy given by Dr. Christison,* the blood was analysed about three months after the commencement of the fever, with the following results. At the time of the examination the urine was increased in quantity. 'The blood presented a thin buffy coat, a very small crassamentum, an abundant slightly lactescent serum of the high density 1031.' The corpuscles were diminished to a third of their proper amount, the fibrin and water increased. In this case, as in others, Dr. Christison considered the milkiness of the serum to indicate the presence of oil.

Corpuscles and albumen diminished.

Frerichs has also found fat in considerable quantity in the serum, under similar circumstances.

Fibrine and water increased.

Dr. Hassall† has examined the blood in a fatal case in which, although no post-mortem was obtained, it is evident from the symptoms that tubal nephritis existed, with fatty change in the epithelium. The albumen was found to be diminished to about a third of its normal amount.

Urea has been found in the blood,‡ and in the cerebro-spinal fluid in patients who have had the disease in question—once as the result of cholera, once of typhus.

Urea and uric acid present.

I obtained a considerable quantity of uric acid from the brain-tissue of a young woman who had died of convulsions consequent upon scarlatinal albuminuria. The kidneys were large, smooth, and injected.§

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* Dr. Christison on Granular Degeneration of the Kidney. Appendix. Case 10.

† Lancet, 1864. Case of Edward G.

‡ Lehmann's Phys. Chemistry. Cavendish Society, vol. i. p. 165. See Path. Trans. vol. xviii. Case by Dr. Cayley.

§ Path. Trans. vol. xviii.

GRANULAR DEGENERATION.

The analyses which have been made of the blood in this disease will show the truth of the general statement which has been made.

Dr. Bright gives the analysis of the blood, as made by Dr. Owen Rees, in two fatal cases of granular degeneration.*

Both were characteristic examples of the disease, and were attested by post-mortem examination.

These observations accord with others in the diminution of albumen and corpuscles, but not as regards the apparent diminution of salts.

Corpuscles and albumen diminished. Water increased.

Dr. Hassall has given an analysis of the blood in a case of albuminuria associated with gout, which from the particulars he gives may be looked upon as certainly one of granular degeneration. The water was increased, the albumen was diminished. The fibrine and corpuscles taken together were diminished.†

Albuminuria of pregnancy.

Dr. Harley has given elaborate analyses of the blood from a case of the albuminuria of pregnancy, in which the blood was examined during the presence of dropsy and albuminuria previous to delivery, and again after delivery, when the patient was in apparent health.‡

The comparison shows that, during the disease, water and inorganic salts were increased, the albumen and corpuscles diminished, the fibrine not much altered, but diminished to a slight extent.

Speaking generally, it may be said that with granular degeneration the blood does not become so much impoverished as with the more acute disorder, but that it equally abounds with urea, and probably with other excrementitious matter.

DEPURATIVE KIDNEY.

The readiness and certainty with which this disease can be recognised enables us to turn to account some of the cases of the earlier observers, and discover a significance in their writings which was hidden from themselves.

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* Cases of Charles Scott and Wm. Curtin, by Drs. Bright and Owen Rees. Guy's Hosp. Reports, 1843, pp. 196 and 209.

† Lancet, 1864. Case of Francis S., Dec. 17.

‡ Harley on Albuminuria, p. 37.

Dr. Bright reports a case of albuminuria complicated with phthisis and ulceration of the bowels, in which the waxy condition of the spleen, liver, and kidneys was clearly described, though not by name.* The loss of albumen and corpuscles is considerable. It is to be regretted that the fibrine was not estimated separately, but Dr. Christison has to a certain extent supplied the deficiency. He gives the case of a lad 16 years of age, who presented the symptoms of the disease in a very marked way, though it is not clear what the primary disorder was. Thirst, frequent micturition, and œdema, were succeeded by headache, insensibility, and convulsions. The head symptoms were apparently coincident with suppression or great diminution of urine. During the last two days of his life he was bled to 60 ounces.†

Albumen and corpuscles diminished.

The post-mortem examination showed extensive hepatization of the lungs. The liver was somewhat translucent, the spleen partially of a rose-red, the mucous coat of the bowels 'as if soaked with serum,' an appearance very characteristic of the depurative change. The kidneys were pale, finely granular on their surfaces, marked with stellate vessels; on section, greyish yellow in the cortical part, of a pale rose colour in the cones.

On analysis the serum of the blood had a density as low as 1019. The blood globules and the solids of the serum were greatly reduced, the water was greatly increased; the fibrin was increased to nearly double its proper amount.

Fibrin increased.

The blood contained a large quantity of urea. In this case, the extreme poverty of the blood must be attributed in some measure to the remorseless blood-letting. In connection with the increased amount of fibrin, it may be mentioned that the heart and large vessels were found to contain very large and tenacious coagula.

Urea present.

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* Case of James Back. Guy's Hosp. Reports, 1843.

† Dr. Christison, *loc. cit.* p. 194. Case 7.

Analysis of Blood in Albuminuria. Proportions in 1,000 parts.

Case	Water	Corpuscles	Fibrin	Corpuscles and fibrine together	In 1,000 parts of Serum			
					Solid matter	Albumen	Salts (inorganic)	Urea
Average Composition of healthy Blood according to—								
Christison	775·7	137·1	3·8	140·9	83·4	—	—	
Owen Rees	792·2	—	—	119·95	87·85	79·5	7·5 (alk.)	
Hassall	787·6	—	—	143·0	—	69·4	—	
In Tubal Nephritis—								
1. Case 10, p. 208. After Scarlatina. Dr. Christison	857·2	42·7	4·5	47·2	95·6	—	—	
2. Lancet 1864. Edw. G. With fatty change. Dr. Hassall	889·5	—	—	86·8	—	23·7	—	
Frerichs. Scarlatinal dropsy. Youth, aged 18	908·10	130·7	3·4	131·4	91·9	81·4	9·09	
„ „ „ Girl, aged 21	938·9	122·0	4·2	126·2	61·1	51·7	—	
In Granular Degeneration—								
3. Dr. O. Rees. Guy's H. R., 1843. Wm. Curtin	853·11	—	—	65·61	81·28	68·5	6·0 (alk.)	·05
4. „ „ „ Chas. Scott.	835·85	—	—	81·61	82·52	—	—	
5. Dr. Hassall. Lancet 1864. Francis S.	821·0	—	—	120·0	—	59·0	—	
6. { Dr. Harley. Albra. of pregnancy. Before delivery	825·9	103·51	2·30	105·81	72·68	60·69	9·08	
„ (patient convalescent). After „	768·7	141·7	2·85	144·55	94·0	86·5	5·000	
In Depurative Disease—								
7. Dr. Christison, p. 194. Case 7	885·3	56·4	6·2	62·6	52·1	—	—	
8. Dr. Owen Rees. James Back. Guy's H. R. 1843	828·9	—	—	94·1	76·98	65·15	—	

BLOOD IN ALBUMINURIA GENERALLY.

It would be easy to accumulate a great multitude of blood analyses in albuminuria, but I have preferred to make use only of such as can be associated with a definite condition of kidney.

Differences of each disease imperfectly known.

There probably remains much to be learned. We can as yet make no very marked distinction between the blood in each disease, though it is obvious that differences must exist, from the fact that the symptoms which result from the state of blood are different in each case. It is clear that with the granular kidney the blood becomes less watery than as the consequence of nephritis, and it may be surmised, though the evidence is insufficient to prove it, that with the depurative disease the fibrine is increased to a more marked degree than with other disorders.

Urea has been found in the blood with each type of kidney, and we are not as yet able to say that there is any excrementitious matter which belongs to the blood of one disorder rather than another.

Blood-change.

Source of evil.

Changes in the blood, of which some have been described, while perhaps others are as yet unknown to us, are the immediate cause of many of the evils which follow upon albuminuria. The absence of change in the nervous centres themselves, notwithstanding that their function is disturbed or abolished, leads to the inference that it is in the fluids, not in the solid structure, that the alteration takes place. This hypothesis is the more satisfying, since the symptoms present in these cases often bear a great resemblance to the effects of some of the narcotic poisons; for instance, opium and belladonna. Besides the presence of excrementitious matter, the superabundance of water in the blood has been supposed, probably with justice, to play an effective part in the production of the symptoms. This seems to be especially the case when the symptoms are of a convulsive kind, convulsions being known to result from excessive depletion.

'Uræmia.'

The general condition is expressed by the word uræmia, which must be held to imply nothing more specific than that the blood is altered by the presence of materials which in their own shape, or under another guise, ought to have passed out by the kidneys.

Urea and uric acid formed in kidney.

The opinion was formerly held, that urea and uric acid were produced in the blood, and that the office of the kidneys was merely to remove these substances from the circulation. Recent experiments have thrown doubt upon this view, and it now appears that both compounds are manufactured in the tissue of the kidney.*

Their insufficient production.

It is probable that the symptoms of blood-poisoning which belong to renal disease do not result solely from these substances, but in part from the accumulation of the creatine and extractives; the imperfect action of the gland providing insufficiently for their further transformation into the constituents of urine. We must also attribute something to the loss of corpuscles and of albumen, as well as to the increase of water. Especial symptoms, such as a proneness to the deposition of fibrin in the vessels and tissues, result from an excess of this substance in the blood.

Other changes.

Carbonate of ammonia.

Carbonate of ammonia—the result of the transformation of urea—has been regarded as the source of much mischief. This hypothesis is due to Frerichs. It is known that the ammonia which always exists in the breath is increased in quantity when the kidneys are diseased. It is known, also, that the injection of carbonate of ammonia into a vein causes convulsions and nervous disturbance. But the exhalation of the ammonia by the lungs is so rapid, that a very large quantity may be introduced into the circulation with only temporary results. It cannot be supposed that this substance can be made in the body faster than such experiments show that it passes off in the breath. Ammonia has indeed been obtained from the blood in cases of renal disease, but there is little doubt that it has resulted from changes in that fluid after its removal from the body.†

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* See the Researches upon Uræmia, by Dr. Zalesky. Tübingen, 1865.

† Hammond on Uræmic Intoxication. American Journal of Medical Sciences, 1861, p. 64.

Symptoms due to state of blood.

The symptoms which result from such changes in the blood as have been described, have been sufficiently indicated in the particular account of each disorder. Some of the disturbances which have formerly been assigned to uræmia are now known to depend upon specific local changes. The diarrhœa of the depurative disease depends upon alteration in the intestinal vessels; the vomiting and dyspepsia often upon similar alterations in the vessels of the stomach; the affections of vision which accompany granular degeneration upon morbid changes in the retina. But there remain many, and most grave, affections of which the cause lies in the state of the blood.

Of these the most important are the disorders of the nervous system, the coma, and epileptiform attacks by which renal disorders are so often terminated, and the lesser affections, drowsiness, headache, cramps, and convulsive movements, as well as various alterations in the temper and state of mind. Vomiting is often a prominent symptom, and it is said that urea and carbonate of ammonia have been found in the matter discharged from the stomach. Diarrhœa, though it sometimes occurs, is less frequently present, except when associated with the depurative change. There is reason to believe that many of the inflammatory disorders which are apt to come on apparently spontaneously in the course of renal disease, result directly from the condition of the blood. It has been shown that the injection of urine or urea into the circulation of animals frequently sets up pleurisy and pericarditis, and it seems that the urinary excreta, when present in the blood, have an irritant effect upon the tissues.

CHAPTER XVI.

ALCOHOL AS A CAUSE OF RENAL DISEASE.

IN estimating the effect of spirituous liquors upon the kidneys, it is necessary to exercise considerable caution. Any agent which is thought to be powerful for evil is certain to be credited with mischief which it has had no share in producing.

General use, a source of error.

The use of alcoholic drinks in some shape is almost universal. Among hospital patients in England there are but few male adults who cannot be convicted of a somewhat liberal use of beer or gin, while in Scotland whiskey drinkers are relatively as numerous. There is probably no disease which is common in London or Edinburgh of which a majority of the men who suffer from it could not be convicted of intemperance in the article of alcoholic liquors. But to suppose that every disease which affects a person of such habits results from the action of the liquor is equivalent to believing that drunkenness confers a protection from all diseases excepting such as are consequent upon itself.

Among those who have become the subjects of renal disease we shall, unless alcohol act as a preventive, necessarily find a large proportion who have been somewhat liberal in the use of this stimulant. The statement of Dr. Christison, that three-fourths, or even four-fifths, of the cases of granular degeneration of the kidneys which occur in Edinburgh are referable to a greater or less degree of intemperance, may be interpreted to mean that the majority of Scotchmen drink whiskey to what Dr. Christison considers an intemperate extent.*

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* Christison on Granular Degeneration of the Kidneys, p. 110. In the term granular degeneration this author includes several varieties of renal disease.

Pathological evidence. In order to obtain reliable evidence relating to the action of alcohol upon the kidneys I have examined into the morbid appearances found in the bodies of persons who had died of delirium tremens; presuming upon such an end as evidence of inebriate habits, and also into the post-mortem condition of individuals who, having been notorious drunkards, met with a violent death.

Kidneys after death by delirium tremens. From the records of the post-mortems at St. George's Hospital I have been able to obtain the details of fifty-two examinations, all of adult males, who had died in the medical or surgical wards of delirium tremens. From the same source I have taken for comparison the same number of the examinations of adult males who had met with accidental death, excluding such as had been notoriously drunken. It may be fairly presumed that the delirium tremens class had been on the whole more addicted to drinking than those who died of simple accident. The state of the kidneys may be thus stated:—

Condition of Kidneys	Delirium Tremens, 52 Cases	Accident, 52 Cases
Natural	28	32
Congested	14	5
Slight or uncertain change in cortex .	3	1
Large, smooth, mottled	3	1
Granular surfaces	3	6
Cysts, without other change . . .	1	7

Of those who had died of delirium tremens, the average age was thirty-eight years; of those who met with accidental death the average age was forty-one years.

After accidental death in drunkards. For the second class of cases I may refer to the valuable papers by Dr. Ogston,* who has recorded with minuteness the post-mortem appearances in the bodies of 117 persons of both sexes, who had been 'by habit and repute' drunkards, and who met a sudden death by accident or suicide. The kidneys were natural in 68 cases, diseased in 49. The alteration was as follows:—

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* See paper by Dr. Ogston of Aberdeen, Med. Chir. Review, vols. xiii. and xiv.

Kidneys simply enlarged	7
Congested	13
Fatty	9
Granular degeneration, including such as were described as shrunk and cysted	7
Cortex simply shrunk	9
Nature of change uncertain	3
Containing an abscess	1

Another writer, Dr. Peters of New York, who has examined the bodies of nearly seventy persons 'who had died from the excessive use of ardent spirits,' thus sums up the changes observed in the kidneys.*

After death from spirit-drinking.

'The kidneys are generally somewhat enlarged, flabby, their cortical substance infiltrated in numerous small spots, with a whitish matter, either albuminous or fatty. Occasionally they are granular.'

Deductions.

From the pathological facts which have been brought forward it will be possible to form some estimate as to the effects of alcohol upon the kidneys. It is possible that such deductions, resting as they do upon simple observation, may not accord with opinions which have been based on theoretical considerations.

From delirium tremens series.

In the series of delirium tremens cases, renal changes are slightly more frequent than when death has resulted from accidental causes not ostensibly preceded by intemperance. The excess is due to mere congestion, to enlargement while the surface remains smooth, and to other alterations affecting the cortical tissue. These conditions all point to the state of the tubes, and are evidently connected with nephritis rather than with granular degeneration. Granular degeneration is absolutely less frequent after delirium tremens than when death has resulted independently of alcoholic poisoning.

From Dr. Ogston's cases.

From Dr. Ogston's cases, though we have not the same means of comparison, we are led to a similar result. The most frequent departure from the natural state is congestion. Fatty transformation, or in other words occupation of the tubes by fatty epithelium, was noted in 9 cases of the 117, while granular degeneration occurred in but 7, a proportion probably not larger than would have been found in the same number of persons of ordinary habits. It appears from these, as from the previous series of cases, that the changes induced by alcohol are such as affect the tubular rather than the intertubular structures. The prevalence of fatty deposit in the epithelium is, as has been shown, not necessarily accompanied by disturbance of function, and cannot be regarded as disease so far as the kidney is concerned. When it occurs as the result of drinking, the change is probably shared by other organs.

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* New York Journal of Medicine. November 1844.

From Dr. Peters's cases.

Dr. Peters's observations also testify to the frequency of changes in the cortical part of the kidney as the result of drunkenness, while granular degeneration is described as 'occasional.'

From these independent observations we may infer that alcohol has little tendency to render the kidneys granular.

Alcohol causes fatty change, and sometimes tubal inflammation.

It frequently causes an increase of oil in the renal epithelium, and in some cases gives rise to changes in the tubular structure which indicate an inflammatory or catarrhal condition. It is an irritant to the secreting tissue, though, unlike cold and scarlatina, it would seem to be rarely sufficiently active to set up such disturbance as to occasion the symptoms of renal disease.* This is evident from the rarity with which attacks of evident renal inflammation can be traced to intemperance.

Cirrhosis of liver seldom accompanied by same change in kidney.

Excess in spirituous drinks occasions cirrhosis of the liver, and it is believed that a similar fibroid change in the lung often owns the same cause. But the kidney is placed under different circumstances, and seems to participate but slightly in such results.

When exaggeration of the fibrous structures is produced by valvular disease, the change is usually general, and affects the kidney in common with other organs. The kidney and the liver are equally exposed to the venous congestion which is the immediate cause of the alteration.

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* A striking case of tubal nephritis, due to the inhalation of alcohol, is quoted, p. 80.

But when the fibrous tissue is affected by alcohol introduced by the stomach, the case of the two organs is very different.

In forty cases of cirrhosis of the liver, in which that change had occurred independently of disease of the heart, and was for the most part associated with spirit drinking, the kidneys were found to be granular in but eight, this disorder being generally in a comparatively early stage. These proportions show the remote subservience which the kidneys acknowledge to the property of alcohol, in virtue of which it renders the liver cirrhose.

Different circumstances of kidney and liver.

The different relations which the kidney and the liver hold towards the stomach may explain the inequality which exists. Spirit, or anything which is absorbed by the gastric blood vessels, is carried directly to the liver by the portal vein. It is then mixed with the blood of the ascending cava, and conveyed to the lungs, and cannot reach the kidney or any part of the general circulation until it has been subjected to the action of both the liver and the lungs, and become incorporated with the general mass of circulating blood. It may therefore be believed that alcohol, though tending to produce increased growth of fibrous tissue in the parts which it reaches in a comparatively unmodified form, exerts but little influence of this kind upon the kidneys. When indeed a large quantity has been taken, the whole system may be saturated, and alcohol may be excreted with the urine. A case is even reported by Dr. Ogston in which the urine of a person who had died drunk was so much charged with this fluid as to give off vapour which caught fire over the flame of a lamp. From such facts, and from the known diuretic action of alcoholic liquors, there can be no doubt that the kidneys take a share in removing any superfluity from the system, and it has been shown that their secreting portion occasionally suffers in consequence, but they are not exposed to the immediate action of the spirit, as are the structures which intercept it on its road and take toll before it reaches the general circulation.

Kidney remotely exposed to action of alcohol, seldom made granular thereby.

Although granular degeneration, as has been shown, is rarely produced by the direct action of alcoholic drinks, it may be engendered indirectly as the consequence of gout. It does not appear, however, that under such circumstances the renal disorder is so frequent as where gout has resulted from the action of lead. The association of gout and renal disease has been considered elsewhere.

Proportion of Deaths from Alcoholism, and from Renal Disease, in various places. 1863.

	Deaths from Renal Disease	Deaths from Alcohol
	1 in	1 in
City of Aberdeen	49	348
County of Aberdeen (excluding city) . .	56	740
London	89	317
Rural parts of Metropolitan Counties . .	80	543
Glasgow	142	445
Lanarkshire (excluding Glasgow) . . .	141	1,186
Dorset	75	1,181
Herefordshire	75	644
Sussex	77	896
Devon	84	2,381
North Riding of Yorkshire	102	899
East Riding of Yorkshire	136	633
Lancashire	137	345
West Riding of Yorkshire	148	800
Rural Districts of Scotland (mainland) . .	103	677
Town " " . .	112	474
Insular " " . .	188	613

Inferences from reports of Registrar-General.

Amount of drunkenness not proportionate to amount of renal disease.

Some inferences as to the effect of alcohol may be deduced from the reports of the Registrar-General, by which we are enabled to place the amount of intemperance in apposition with the frequency of renal disease, in various parts of the kingdom. Disease of the kidney is not evenly spread over the land, but displays striking differences on comparing one locality with another. The proportion of deaths from alcoholism—including delirium tremens as well as the more direct result in intoxication—may be taken as giving a rough but probably not very erroneous estimate of the amount of inebriety which prevails. It appears that the prevalence of the vice has no relation to the frequency of renal disease. Whatsoever influence alcohol may have as a cause of renal disorders, there are other agencies, in this respect more potent, by which it is overridden. The places where death from drunkenness or delirium tremens is most frequent are not those where renal disease most abounds, and indeed in some instances enjoy a remarkable immunity from such disorders.

London and metropolitan counties.

Renal disease as a rule is more common in the sober agricultural districts than in large towns. In the metropolis there is more drunkenness, and less disease of this kind than in the rural parts of Middlesex, Surrey and Kent. Lancashire, which with its great manufacturing towns is preeminent among the counties for the proportion of deaths which are attributed to alcohol, is one of the most free from the class of diseases in question. The agricultural counties of the south, though necessarily free from intemperance as from all vices which spring from exuberant wealth, are among those which suffer most severely. The rural districts of Scotland are, generally speaking, less addicted to excess in alcoholic liquors, while they show a larger proportion of renal disease than the large towns of the same kingdom. Glasgow is remarkably free from such disorders, an advantage which cannot be attributed to abstemious customs.

Lancashire.

Southern counties.

Rural and town districts of Scotland.

Glasgow and Aberdeen.

Glasgow and Aberdeen, though differing exceedingly in their renal proclivities, are much the same in their habits of intemperance. And comparing each city with the country around it, it appears that the greater inebriety of the urban population does not produce any appreciable increase in the amount of renal disease.

General conclusions.

Hence it would seem that, in accordance with what has been derived from pathological observations, the use of alcoholic drinks is comparatively inoperative as causing disease of the kidneys.

It has, indeed, been shown, that such fluids when taken in great excess may set up a state of renal catarrh, though compared with other causes of tubal inflammation, this one is of rare operation and almost insignificant in its numerical results.

It appears also, that certain liquors, by causing gout, may bring about granular degeneration, but that this sequence is less common than when the gouty diathesis is connected with the absorption of lead.

And lastly, granular degeneration may result from the extension to the kidney of a fibroid change, such as ardent spirit produces in organs more immediately exposed to its action—though this event is comparatively infrequent, and the organic alteration, when it occurs, is generally less decided in the kidney than in the liver.

But each of the issues which have been described is of rare occurrence. Alcohol attacks other structures in preference to the kidneys. As causes of renal disease there are other agents, the more obvious and immediate have been previously considered, which are greatly more mischievous; and there is a great atmospheric power, which overshadows all the other circumstances which tend to produce renal inflammation or granular change.

CHAPTER XVII.

CLIMATE IN RELATION TO RENAL DISEASE.

Geographical distribution of diseases.

MANY diseases, like plants and animals, are distributed over the surface of the earth in obedience to laws which make living subservient to inanimate nature. If we know the range of temperature of a country, we can predict with some approach to accuracy the diseases which will be found among the inhabitants. In Arctic climates, catarrhal affections of the organs of respiration; in temperate countries, tubercular and renal disorders; within the tropics, dysentery, hepatitis, and virulent febrile diseases, prevail.

Sources of information.

With regard to renal disease in particular, it will be necessary to follow its distribution somewhat in detail, so as to ascertain how far external circumstances are able to control its development. The recent spread of schemes of registration has given us a means of measuring the relative frequency of fatal diseases, in cities which present extreme differences of climate. The army medical reports, under the superintendence of Dr. Graham Balfour, giving as they do the health of large bodies of troops all over the world, furnish the results of a series of experiments in geographical medicine such as could have been made by no nation but Great Britain. In a more narrow area, the registrars' reports for England and Scotland supply important details.

Renal disease in various cities, from registrars' reports.

It may be convenient to present in a condensed form some of the information which has been gained from such sources, before proceeding to further consideration of the subject.

The mortality from renal disease in several great cities—taking cities together so as to compare similar communities—is placed first.

The proportion of deaths from renal disease to the total number of deaths is, in—

		Mean Annual Temperature
Aberdeen	1 in 49	47·0
London	,, 89	50·3
Edinburgh	,, 95	47·2
Dundee	,, 107	—
Melbourne	,, 110	57·
Glasgow	,, 142	46·9
Paris	,, 266	52·4
Bombay	,, 2,800	80·6
Genoa	0 in 4,303	61·0

This is taken from published registers of causes of death. As renal disease, have been included all the deaths which, according to the phraseology in use in each register, are assigned to Bright's disease, albuminuria, nephria, nephritis or kidney disease. The numbers concerning the towns of Great Britain relate to the year 1863; with regard to the foreign cities, the latest sources of information in each case have been used. The places are arranged according to their liability to renal disease. The comparatively cold cities of Great Britain and Australia come first, Aberdeen occupying a bad eminence in this respect. Paris, though not differing very much in temperature from the warmer of these, has a somewhat less proportion of renal disease. Genoa, with its almost tropical climate, has an exemption, which, for reasons which will presently appear, does not extend to Bombay.

Renal disease in the British army, from army medical reports.

As a further exemplification of the effects of climate in the development of albuminuria, the following table has been calculated from the six published volumes of the army medical reports. The numerical strength of the garrison in each place, taking the average of the six years, has been used as the standard of comparison. The proportion of deaths from kidney disease, including both 'nephria' and 'nephritis,' is stated in the first column; the proportion of attacks of 'nephria' or chronic albuminuria is given in the second, both referring to the mean of the six years. It has been judged right to exclude the cases described as 'nephritis' from the second column, since it appears that especially in India disorders not renal, but probably of a rheumatic character, are classed under this heading. 'Nephritis,' however, when not renal is not likely to be fatal, and therefore the confusion which has been alluded to will not interfere with the column which relates to the deaths. The nine most important stations of the British army have been included. In six of them the mean temperature and the monthly range of variation has been annexed, from the report for 1864. The table refers only to British as distinguished from native troops.

Table showing the proportion of Renal Disease among the British Troops in various places, with the Mean Temperature and monthly range.

Place of Troops	Deaths from Renal Disease, to Annual Strength	Admissions from 'Nephria,' to Annual Strength	Temperature taken at	Annual mean Temperature	Mean Monthly Range
	1 in	1 in		°	°
Australia . . .	5,547	5,527			
New Zealand . .	9,484	2,032	Auckland .	60·3	33·4
Great Britain .	10,059	3,722	Aldershot .	49·4	37·4
Mediterranean .	11,042	5,521	Gibraltar .	64·2	27·0
British America .	11,667	2,000	Halifax . .	43·8	44·4
India	12,795	4,846	Bombay . .	80·6	20·1
Cape of Good Hope	13,050	26,101			
St. Helena . .	—	1,143			
West Indies . .	—	11,070	Jamaica . .	80·6	24·5

The places are arranged according to the frequency of renal disease as a cause of death. It at once appears that the temperate stations are most exposed to the disease, while those within the tropics are comparatively exempt.

The next source of information has been the reports of the Registrar-General for England and Scotland.

Mortality from renal disease in United Kingdom, from registrars' reports.

The following are the proportions of deaths from albuminuria or kidney disease to the total number of deaths from specified causes in Great Britain, in the year 1863 :—

In England, 1 death in 106 was from this cause.
" Scotland, " " 109 " "
" Wales, " " 131 " "

Of the several divisions of Scotland:

In the Mainland rural districts, 1 in 103 was from this cause.
„ „ Town „ „ „ 112 „ „ „
„ „ Insular „ „ „ 188 „ „ „

The same facts, referring to many of the counties in detail, selecting those to which observations on climate can be appended, are given in a tabular form. The numbers refer to the year 1863 only, excepting where, from the smallness of the numbers or some other source of error, it was thought advisable to take the mean of two consecutive years; and in the cases of Shetland, Orkney, Caithness, and Sutherland, where the numbers refer to the whole length of time for which the detailed reports have been published.

The observations as to temperature refer to the year 1863 only. Where possible the mean of two stations within the county has been given.

Table showing the Mortality from Renal Disease in several counties of England, with the annual Mean Temperature, and the monthly range of variation.

	Deaths from Renal Disease	Annual Mean Temperature	Mean monthly variation of Temperature		Deaths from Renal Disease	Annual Mean Temperature	Mean monthly variation of Temperature
	1 in				1 in		
Berkshire . .	71	50·7	34·3	Warwickshire .	96	—	—
Middlesex . .	73	50·3	36·5	Northamptonshire . . .	98	—	—
Dorset . . .	75	49·8	33·7	Hertfordshire*	103	49·2	36·9
Sussex . . .	77	51·2	37·5	Westmoreland†	115	—	—
Surrey . . .	78	—	—	Cornwall * .	119	51·5	30·6
Cambridgeshire	84	49·8	35·2	Northumberld.	120	46·8	30·6
Devon * . . .	84	51·3	33·4	Bedfordshire *	121	49·3	29·2
Kent . . .	84	50·3	36·5	Lancashire * .	137	48·7	33·0
Norfolk * . .	84	50·1	33·4	Cumberland .	152	47·8	31·5
Somerset . .	90	49·2	34·9	Durham . .	155	—	—
Oxfordshire .	94	51·1	33·9				

* Observations from two positions within the county. Mean given.

† Deaths calculated for two years.

Corresponding Table for Scotland.

	Deaths from Renal Disease	Annual Mean Temperature	Mean monthly variation of Temperature		Deaths from Renal Disease	Annual Mean Temperature	Mean monthly variation of Temperature
	1 in				1 in		
Aberdeen	53	47·0	30·7	Inverness	127	46·5	23·4
Caithness *	67	—	—	Lanark	143	46·9	26·6
Edinburgh †	82	47·7	31·8	Orkney *	148	45·8	22·7
Fife	94	47·4	31·5	Ayr	163	48·9	23·1
Perth ‡	104	48·5	33·8	Argyll	198	47·3	23·0
Forfar	107	47·8	30·3	Shetland *	487	43·8	19·9
Sutherland *	118	47·0	30·6			—	—

* Deaths calculated for nine years.

† Observations from two positions within the county. Mean given.

‡ Deaths calculated for two years.

General distribution of renal disease.

The counties are arranged according to the frequency of renal disease, compared with other causes of death. It appears that the county of Aberdeen is preeminent among counties, as the city among cities, while the Shetland Islands, with their almost arctic climate, enjoy an immunity from the disease which is not approached by any other part of the kingdom. Further, it may be observed in passing, that within the limits of each kingdom, particularly in Scotland, where the climateric differences are more marked, there is a striking general correspondence between the amount of renal disease and the changeability of the temperature.

The details which have been brought forward may serve as a guide to the geographical distribution of renal disease.

Most frequent in temperate climates,

Parts of Europe,

Australia,

It appears that albuminuria as a primary disorder belongs especially to temperate climates. Arctic cold and equatorial heat are equally inimical to its development. It chiefly abounds where the mean temperature of the year is not far removed from 50°. It is common in Paris, in Germany, and in Great Britain. In the southern hemisphere, exposure to a similar climate is attended with the same results. In Melbourne, with a mean temperature of about 57°, the disease appears to be scarcely less prevalent than in London. This appears from the results of general registration, while the mortality from kidney disease in the Melbourne hospital—

one death in thirteen—is much what occurs in similar institutions at home. Among the troops quartered in Australia the disease is certainly not less frequent than in the United Kingdom, though from the comparatively small size of the garrison it is not safe to draw minute inferences from the numbers given in the table. The same statement, however, applies to New Zealand, which with a similar temperature employs a much larger number of troops.

New Zealand.

All the places which have been ascertained as liable to a large proportion of renal disease have an annual mean temperature which is not lower than 46°, nor higher than 57°; where there is no continuous cold approaching freezing point, and no continuous heat even of such moderate amount as prevails in the South of France and the Cape of Good Hope. Renal disease appears to flourish where there is heat enough to allow of the successful cultivation of wheat, but not so much as to replace deciduous trees by the palms and other endogenous plants characteristic of tropical climates. Within this temperate range the disease seems to increase with the changeability of the temperature.

Rare in cold climates.

In whichever direction we leave, the regions where such climate prevails, we find albuminuria less common. In our own country, the colder Hebrides are comparatively free, while the Shetland Islands, with their ungenial summers and uniformity of cold weather, are less affected than any other part of the kingdom.

Shetland.

North America.

Under the frozen winters of Northern America, where the thermometer, though high in summer, is under 32° for four months in the year, the garrison has a lower mortality from renal disease than in Great Britain, Australia, or New Zealand. Although the variation of temperature is here very great, the greater part of the year is below the point at which the kidneys are much exposed to disease.

Iceland.

Still further north, I have been able, through the courtesy of Dr. Hjaltelin, the chief physician of Iceland, to whom I am glad to acknowledge my obligation, to import some facts of modern pathology from that ancient seat of learning and civilisation. In answer to an enquiry, Dr. Hjaltelin writes:—

'According to all circumstances which I have been able to observe in Scandinavia, Germany, and your native country, renal diseases are no doubt far more common in those countries than in Iceland; this is, no doubt, contrary to what might be expected, for as most diseases resulting from cold ought to be far more common than in temperated localities, so we might expect to find the Morbus Brightii very frequent in Iceland. This is, as aforesaid, by no means the case.'

Arctic circle.

From this we may infer that albuminuria is rare in Iceland. 'The shuddering tenant of the frigid zone,' among his other advantages may boast his freedom from renal disease. And in the uninhabited polar regions it has been already shown that renal anasarca is not one of the disorders to which travellers are liable.

Diminishes towards the tropics.

Pursuing the enquiry in the contrary direction, and leaving temperate for warmer latitudes, we find that excepting when it occurs in the depurative form, as the consequence of other complaints, the disease diminishes as the temperature increases.

Genoa.

On the Mediterranean coast albuminuria is extremely rare. Dr. Chambers* ascertained that at Genoa, where the mortality is registered much as in London, kidney disease does not appear as a cause of death, while the deaths ascribed to anasarca or general dropsy are in Genoa 1 in 239, in London 1 in 93. The same writer compared the admissions at the Milan Hospital with those at St. Mary's Hospital, London, with the object of ascertaining the kinds of disease prevalent in the neighbourhood of each. At Milan, Bright's disease, or dropsy with diseased kidneys, occurred on an average once in 2807 admissions; while at St. Mary's, the proportion was 1 in 31, the affection being nearly a hundred times more frequent in London than in Milan, for the same number of patients. It is probable that this difference is somewhat exaggerated. From the rarity of the disease in Italy, it is necessarily but little understood, and probably

Milan.

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* Chambers on the Climate of Italy.

escapes notice more often than in London. English physicians, however, who practice in Rome speak of albuminuria as almost unknown there, excepting in association with phthisis, the disease being probably of the depurative variety, and consequent upon the pulmonary disease.

Rome.

Referring to the army reports, we find that the troops quartered at Gibraltar, Malta, and the Ionian Islands, are less amenable to albuminuria than those in Great Britain, New Zealand, or Australia, though from the necessarily short time they remain, the climate tells less upon them than upon the more permanent residents.

Mediterranean garrisons.

As the heat increases renal disease further diminishes. It is exceedingly rare at the Cape of Good Hope, which has a mean temperature of about 66°, while in the West Indies, with a mean temperature of 80°, the troops are more free from the disease than in any other place of which we have record.

Cape.

West Indies.

With regard to India, over a large portion of which the heat is as great as in Jamaica, albuminuria, according to the army reports, is less rare, though still infrequent as compared with Great Britain. We have the testimony of Sir Ranald Martin,* as to the rarity in India of diseases of the lungs, air-passages, and kidneys; and the results of registration as concerning the city of Bombay represent that renal disorders are exceedingly rare compared with other causes of death; about one-tenth as common as in Paris, not a twentieth so common as in London. The disease is, however, less uncommon than in some other tropical countries, apparently in consequence of the great prevalence of dysentery and the resulting frequency of the depurative change.

India.

The greater prevalence of albuminuria in Bombay than in Genoa is owing to the frequency of dysentery in the Oriental city.

Dysentery a source of albuminuria.

Dr. Morehead, who describes Bright's disease as common among the hospital-frequenting classes of Bombay, gives the details of a large number of cases of albuminuria which came under his observation in a large hospital in that city, the patients being chiefly natives. In reading these ample and explicit reports it is not possible to avoid the conclusion that the disease was almost invariably of the amyloid or depurative type, and was very often the result of dysentery. Diarrhœa was a symptom of very common occurrence, while uræmic disturbance was generally absent. In a large number of cases which were subjected to post-mortem examination no instance was found of simple hypertrophy of the left ventricle, a change exceedingly uncommon as a result of the depurative disease, though generally present with granular degeneration.

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* Sir R. Martin on the Influence of Tropical Climates, p. 639.

We may therefore consider that though the climate of India does not prevent the depurative disorder, and by leading to dysentery may even increase its frequency, yet that granular degeneration is undoubtedly of rare occurrence in that country. The greater prevalence of dysentery in Hindostan than in the West India Islands accounts for the preponderance of albuminuria in the eastern dominion.

Thus, then, it has been shown that albuminuria, so far as it is dependent upon disease primarily renal, is more frequent in countries which have a similar temperature to England than in those which are either much warmer or much colder, the disease being extremely infrequent with extreme heat, and probably equally so with excessive cold.

Activity of kidneys varies with climate.

The prevalence of the disorder in temperate climates may probably be explained by the axiom that the liability of an organ to disease, particularly to inflammatory disease, bears a general proportion to its functional activity. The respiratory organs are the more active in cold, the kidneys in temperate, the liver and bowels in hot, climates. It has been shown that the urea, the chlorides, and the other constituents of urine, decrease as the air rises in temperature above 49°.* On the other hand, it is believed—a belief which is consistent with much of our knowledge—that the urea lessens also with severe cold.† Dr. E. Smith has shown that even in England during an exceptionally cold year, less urea was secreted by himself during the winter than during the summer months.

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* Parkes on the Urine, p. 95.

† Philosophical Transactions, 1861.

Variability of temperature promotes renal disease.

Beside the mere amount of heat and cold there is a remarkable correspondence between the variability of temperature and the existence of the disease in question. Melbourne, where it prevails to a great extent, is exposed to great variations, and New Zealand, which varies to about the same extent as Great Britain, has apparently as much renal disease. And it will be observed that in the hotter districts an exemption from the disease corresponds with uniformity of temperature, though probably other causes, as have been shown, cooperate in producing this result.

Coasts of Scotland.

In Great Britain itself, especially in Scotland, which without much difference in the habits of the people comprises within a small compass great varieties of climate, and therefore is well adapted to throw light upon an enquiry such as occupies our attention, the correspondence between the amount of renal disease and the variability of temperature is striking. This is well shown by comparing the east coast with the west. On the western coast, where there is scarcely heat enough in summer to ripen wheat, but where the winters are warm from the influence of the Gulf Stream, so that a very uniform temperature prevails through the year, renal disease is not one half so frequent as on the eastern side of the kingdom, where the weather is both colder and hotter than on the Atlantic shore, and undergoes much larger and more frequent variations.

Islands, &c.

It will be observed in the table that the Eastern Counties all come at the beginning of the list, as having a large proportion of renal disease, the Western at the end, as most free, while Sutherland, which has a shore on each sea, occupies an intermediate position. The Islands, which resemble the western coast in their uniformity of temperature, resemble it also in their freedom from renal disease. The places where the temperature varies least are Ayrshire, Argyllshire, and the Orkney and Shetland Islands. These are also most free from such disease, Shetland having the preeminence in both respects.

It appears then, that within the temperate limits where primary renal disease prevails, its amount is regulated by the variability of the temperature.

Fluctuations of temperature a source of disease.

The dependence of renal disturbance upon such fluctuations is in accordance with all our knowledge. The phenomena of 'catching cold' result, not so much from continued low temperature as from abrupt transitions; and the association of the tubal disorder with the series of changes thus familiarly described, has been already shown.

Humidity.

It does not appear that there is any direct connection between the humidity of the air and the organic changes which have occupied our consideration. That they are not promoted by the extreme of moisture is shown by the comparative freedom of the insular districts of Scotland; while on the other hand there are districts, like parts of the Mediterranean coast, where the opposite condition of atmosphere co-exists with an exemption from the disease.

In the preceding account it has not been generally practicable to separate the several renal disorders from each other, but it is sufficiently evident that the variations which have been described depend upon the prevalence of the inflammatory affection, and of granular degeneration, more especially of the latter as the more common disease.

Granular degeneration especially under influence of climate.

With regard to this disorder, so frequent and so little under the control of treatment simply medical, the influence of climate has a great practical importance. This can scarcely be said with regard to the other diseases which have been considered.

The inflammatory affection, indeed, may owe its origin to atmospheric influences, but is generally so rapid in its course and urgent in its symptoms that the subjects of it have no choice but to stay at home. The patient recovers or dies without any interval of health such as would allow of his removal to a foreign country.

The depurative change, not belonging especially to the kidneys, owes its origin to circumstances within the body rather than external to it; and so long as such sources are in operation it will number its victims under every sky.

Practical conclusions.

With granular degeneration, however, the case is otherwise. It is a very chronic disease, and it appears to have a close dependence upon atmospheric influences. The structure of the organ is invaded by slow and often hesitating approaches, and we cannot but admit the importance of any measures which, by removing the tendency to the disease, may save as much of the gland as is yet intact. That the tendency to the disease varies in different countries has been abundantly shown. And though change of climate has hitherto been little resorted to in such cases, so that the results of experience are wanting, it is scarcely possible to question the wisdom of removing a patient in whom the early symptoms have been discerned, to a locality where the genius of the place is opposed to the progress of his complaint.

According to our present knowledge, it would seem that a warm and constant climate should be sought. Where the circumstances of the patient will admit of such a resort, the coast of the Mediterranean, as a winter residence, appears to fulfil the necessary conditions. The Cape of Good Hope would probably answer a similar purpose. It may even be urged that a residence within the tropics, with all its concomitant risks, may be adopted as a preferable alternative to the almost certain progression of the disease in our own chilly and changeable climate.

In the impotency of such medicine as is represented by the Pharmacopœa, we may yet be able to take advantage of those universal laws in virtue of which all life and growth are regulated by the physical conditions of the earth.

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